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Final
Engineering Evaluation/Cost Analysis

Yosemite Slough
San Francisco, California

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List of Abbreviations and Acronyms

ARAR	applicable or relevant and appropriate requirement
AWA	area-weighted average
BAZ	biologically active zone
BMP	best management practice
BPTCP	Bay Protection and Toxic Cleanup Program
BSS	below sediment surface
BVHP	Bayview Hunters Point Redevelopment
°C	degrees Celsius
CCR	California clapper rail
CDPR	California Department of Parks and Recreation
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cm	centimeter
COC	chemical of concern
COPC	contaminant of potential concern
CSLC	California State Lands Commission
CSO	combined sewage outfall
CPSRA	Candlestick Point State Recreational Area
CWA	Clean Water Act
CY	cubic yard
DRET	dredging elutriate tests
E & E	Ecology and Environment, Inc.
EE/CA	Engineering Evaluation/Cost Analysis
EMNR	enhanced monitored natural recovery
EPA	(United States) Environmental Protection Agency
ERM	effects range median
°F	degrees Fahrenheit

List of Abbreviations and Acronyms (cont.)

HPNS	Hunters Point Naval Shipyard
IC	institutional control
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
mg/kg	milligrams per kilogram
MHWL	mean high water line
MNR	monitored natural recovery
Navy	United States Department of the Navy
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
Noble	Noble Consultants, Inc.
NPDES	National Pollutant Discharge Elimination System
NTCRA	non-time critical removal action
PCB	polychlorinated biphenyl
ppm	parts per million
PRP	Potentially Responsible Party
RAO	removal action objective
RCRA	Resource Conservation and Recovery Act
RG	remediation goal
RWQCB	Regional Water Quality Control Board
SCEM	site conceptual exposure model
SFEI	San Francisco Estuary Institute
SFPUC	San Francisco Public Utilities Commission
START	Superfund Technical Assessment and Response Team
STLC	Soluble Threshold Limit Concentration
T/S	transport/storage
TSCA	Toxic Substances Control Act
TTLC	Total Threshold Limit Concentration
UCL	Upper Confidence Limit
VOC	volatile organic compound
VST	vane shear testing

1 Introduction

In September 2011, the United States Environmental Protection Agency (EPA) Region 9 Superfund Remedial Program directed Ecology and Environment, Inc.'s (E & E's) Superfund Technical Assessment and Response Team (START) to support the EPA's environmental data collection activities and the EPA-funded Engineering Evaluation and Cost Analysis (EE/CA) for a planned non-time-critical removal action for contaminated sediment in Yosemite Slough, San Francisco, San Francisco County, California. The EPA and E & E have jointly prepared this EE/CA.

The Yosemite Slough Site, also known as the "Yosemite Creek Sediment Superfund Site" is a shallow marine channel or "slough" connected to San Francisco Bay (see Figure 1-1). For purposes of this EE/CA document, the Yosemite Slough Site will be referred to as the "Site" or "Yosemite Slough." Previous and on-going investigations of the Site indicate Yosemite Slough sediments are primarily contaminated with polychlorinated biphenyls (PCBs) and lead.

This EE/CA has been prepared in accordance with the EPA's *Guidance on Non-Time Critical Removal Action* (EPA 1993). This EE/CA identifies and evaluates a range of cleanup alternatives and recommends the preferred cleanup alternative, hereafter referred to as "cleanup action" for the Site. Also, because the Yosemite Slough Site is a contaminated sediment site, EPA guidance *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites* (EPA 2005), and *Principles for Managing Contaminated Sediment Risks at Hazardous Waste Sites* (EPA 2002) was considered throughout the development of this EE/CA.

Concurrent with the development of this EE/CA, the EPA conducted a detailed analysis to determine the most significant contributors of PCB and metal contamination at the Site. In accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the EPA has identified several potentially responsible parties for Site contamination. Under CERCLA, these parties are called "Potentially Responsible Parties" or "PRPs." The EPA may name additional PRPs for the Site in the future.

M:\Oakland\Yosemite_Creek\Maps\MXD\Report\2012_December\Site_Location.mxd Figure 1-1 Site Location Map

Source: Esri 2011, 2011 National Geographic Society

Figure 1-1
Site Location Map

Yosemite Slough
San Francisco, California

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2 Site Description and Background

2.1 Site Location and Description

The Site is located between Hunters Point and Candlestick Point in the Bayview neighborhood of southeastern San Francisco, California. The Site is approximately 1,600 feet long and 200 feet wide, with an area of approximately 414,000 square feet when irregular/margin areas are included in the total square footage. At typical daily tidal cycles, the western portions of the Site become an exposed mudflat. The eastern portion of the Site is exposed as a mudflat only at lower tides. At mean high tide, 3 to 6 feet of bay water covers the Site depending on location within the Site. The approximate location of the Site is 37° 43' north latitude, 122° 23' west longitude near the street address of 1200 Yosemite Street in the city of San Francisco.

The Site generally consists of sediment within Yosemite Slough below the mean high water line (MHWL) as it existed in December 2010 prior to shoreline changes that occurred in January 2011. Thus, the western and southern boundaries of the Site are defined by the current MHWL, while the northern and eastern boundaries of the Site exclude the California Department of Parks and Recreation's (CDPR's) restoration areas.

The approximate Site boundary is shown in Figure 2-1. A formal survey will be required to establish the official boundaries of the Site.

The majority of lands within the Site, specifically the water-covered lands below the mean high tide line, are owned by the City and County of San Francisco pursuant to a land grant from the State of California under the Burton Act of 1968, 1986 Cal. Stat. Ch. 1333. Certain other submerged lands and tidelands within the Site boundaries are owned by the California State Lands Commission (CSLC), which leases them to the CDPR. Small remaining portions of the Site are privately owned (Alderson 2013).

In addition, there are areas in proximity to the Site that are suitable for use as staging areas, materials handling areas, and for other activities necessary to implement the cleanup response action. These areas are considered "on-site" (40 Code of Federal Regulations [CFR] 300.5).

As shown on Figure 2-1, the south, west and north sides of the Site are contiguous with the Candlestick Point State Recreational Area (CPSRA), which is owned by the California State Lands Commission (CSLC) and managed by the CDPR under a long-term lease (Tobias 2012). The east edge of the Site is contiguous with a portion of San Francisco Bay called "South Basin." Most of South Basin is encompassed within the Hunters Point Naval Shipyard (HPNS) Parcel F, which is owned by the United States Department of the Navy (Navy).

The Site is surrounded by several blocks of light industrial and commercial properties, including metal works shops, an auto salvage yard, auto repair shops, a green waste recycling facility, and other light industrial operations. The light industrial zone transitions to a large residential district to the north, west, and south known as San Francisco's Bayview neighborhood. Gilman Playground and Brett Harte Elementary School are located approximately 0.5 miles south of the Site. Approximately 0.5 miles south of the Site is Candlestick Park, a football stadium with an associated parking lot. HPNS and Candlestick Park are included in a large redevelopment project called the Bayview Hunters Point Redevelopment (BVHP) Plan[1], which consists of recreational, residential, and commercial reuses for the area. As further described in Section 2.8, portions of the CPSRA immediately adjacent to the Site are currently being restored for purposes of creating wetland habitat.

The Site community consists of those living or working in the 94124 zip code, which has a population of approximately 34,500. San Francisco's total population is 815,358 (USCB 2009).

2.2 Site Setting

Eastern San Francisco County originally consisted of extensive natural tidal marshlands. By the early 1900s, most of San Francisco's waterfront north of Islais Creek was fully built out with docks, wharves, and industrial and rail facilities. The only place left on the bay with room for development was the Bayview-Hunters Point district (Kelley and Verplanck 2010). Although limited filling began in the late 1880s, large areas of tidal marshes of Yosemite Slough and South Basin area were filled during World War II to create sites for war workers' housing, leaving only a narrow channel called Yosemite Canal (Dow 1973). Fill material included construction debris and waste, and soil and crushed bedrock from the leveling of the two bedrock hills that were once near the Site. Figure 2-2 shows an aerial photograph of the shoreline taken in 1938. The approximate Site boundary is shown on the aerial photograph for reference.

The CDPR has recently undertaken efforts to restore wetland habitat to the north of the Site. These efforts included the removal of material immediately north of the Site, creating additional tidal flats and wetland habitat. Figure 2-3 shows an aerial photograph taken in August 2012, which shows the revised shoreline

[1] For more information, visit the following Web site: http://www.sfredevelopment.org/index.aspx?page=53

relative to the Site boundary. Figure 2-4 shows an oblique aerial photograph of a portion of the Site at high tide.

To the east of the Site, the Hunters Point Naval Shipyard is being remediated by the Navy under the oversight of the EPA and state of California regulatory agencies. The portions of the Shipyard closest to the Site, Parcel UC-3, Parcel E-2, and Parcel F, have been investigated by the Navy. Releases of metals, PCBs, radionuclides, and volatile organic compounds (VOCs) have been identified in soil, groundwater, and sediments. A 22-acre, 473,000-cubic yard (CY) landfill containing construction debris, waste soil, and industrial waste is located in Parcel E-2. The Navy has conducted multiple cleanup actions in Parcels E-2 with final remedial actions scheduled to be completed in approximately 2018. PCBs and metals are the primary contaminants in sediments in Parcel F, the underwater parcel owned by the Navy that is contiguous with the Site. The Navy is currently testing sediments in Parcel F for potential radionuclides, and a remedy decision for contamination in Parcel F is tentatively scheduled for 2015 followed by remedial design and cleanup action in 2016 or 2017.

2.3 Topography and Site Features

Topographically, the Bayview-Hunters Point area once consisted of several hills and promontories interspersed among low-lying plains and tidal marshes. Two promontories – Hunters Point and Candlestick Point – jut out into the bay.

Almost 6,000 feet long and averaging about 2,000 feet wide, Hunters Point is the area's dominant physical feature. Composed primarily of greenish serpentine rock, Hunters Point rises to 290 feet above sea level. Much of the eastern third of the peninsula was graded flat and deposited into the surrounding bay during the World War II-era construction of the HPNS (Kelley and Verplanck 2010).

Originally covered in native grasses and coastal sage scrub, Hunters Point possessed several streams and subterranean springs. Candlestick Point was originally a significant promontory until it was graded flat and the resulting debris was used to fill the site beneath what is now Candlestick Park stadium and adjacent parking lots. Heavily quarried during the twentieth century, Candlestick (or Bayview) Hill rises to elevation of 375 feet just west of Candlestick Point (Kelley and Verplanck 2010).

2.4 Geology

The shallow sediments within Yosemite Slough are soft, have no structure, and are comprised of fine to very fine grained materials. The sediments exhibit a high water content and low bearing strength. Various textural analysis samples have been obtained across the Slough and the adjacent Navy property in the South Basin of San Francisco Bay (HPNS Parcel F). These samples include three samples collected in 2003 (Noble 2003), and 27 samples collected in 2012 (NewFields 2012b [four samples] and ARCADIS 2012 [23 samples]).

The geology beneath the Site consists of artificial fill along the banks of Yosemite Slough with younger bay mud, bay side sand, and/or Franciscan formation rock (sandstone, graywacke, shale, and chert) within the slough itself. In a 2012 geotechnical study performed at the Site (ARCADIS 2012), seven borings typically indicated the following geologic units below the Site with increasing depth: young bay mud (ranging from 8 to 34 feet thick), medium dense sand (ranging from 12 to 40 feet thick), medium stiff to stiff clay (ranging from 15 to 30 feet thick), and Franciscan bedrock. (See Section 2.13 for additional geological information found during this geotechnical study.)

Geology Adjacent to the Site

Geology beneath the nearby HPNS reportedly includes artificial fill, which can contain serpentinite bedrock, excavated bay mud, sands, gravels, and construction and industrial debris. The fill generally overlies bay mud deposits and occasionally undifferentiated sedimentary deposits (Barajas & Associates, Inc. 2008).

2.5 Hydrogeology

Groundwater flow in the region is believed to flow toward the Site as a groundwater discharge to surface water in the Slough. The Yosemite Creek Drainage Basin is approximately 1,500 acres and located between two hills: Hunters Point to the north and Bayview Hill to the south. The original Yosemite Creek originated from a spring in what is now in McLaren Park and flowed into San Francisco Bay via Yosemite Slough. Yosemite Basin is approximately 3 square miles and is bounded by McLaren Park to the west and San Francisco Bay to the east. The former Yosemite Creek has been separated from its original freshwater origins. The surface water flows from the former creek are captured in pipes and culverts, which are collected, transported via pipelines, and then treated at the City of San Francisco Public Utilities Commission (SFPUC) Southeast Water Pollution Control Plant along with the sanitary and storm water runoff flows.

2.6 Surface Water Hydrology and Tides

The principle hydrologic sources for the Site are direct precipitation and tidal action from San Francisco Bay for those areas within reach of tidal inundation (WRA, Inc. 2006). Based on a hydrodynamic modeling evaluation of the Yosemite Slough, negligible sediment deposition occurs at the western end of the Slough because the current is weak in this dead-end area (Noble 2005). This study also states that the tidal currents' "maximum current velocity is approximately 0.25 meters per second (m/sec), which occurs in the middle and lower canal during the strongest flood and ebb tides." It also states that velocities "are considered low, and not likely to induce noticeable re-suspension of bed material or bed scouring." The western portion of the Yosemite Slough has the least scouring and the wave climate is mild.

Based on a modeling study by Noble Consultants, Inc. (Noble), the CDPR Yosemite Slough Wetlands Restoration Project design is expected to result in most of the restoration area being inundated by water from the San Francisco Bay less than 20% of the time, with maximum tidal current velocities less than 0.05 m/sec (Noble 2005). The weak tidal currents in the restoration area will not likely induce any resuspension of sediment or induce any noticeable erosion in the Yosemite Slough. Restored wetland areas are expected to be stable with negligible bed erosion or deposition. Wave action induced by the 10-year to 50-year storm events could induce erosion at the mouth of the Slough with greater erosion potential east of the Site in South Basin, HPNS Parcel F. During periods of wave action sediment deposition will also occur; therefore, the actual net erosion during the extreme storm events may be less than the estimated erosional potential (Noble 2005). In January 2011, the CDPR completed Phase 1 of its three-phase wetlands restoration project at Yosemite Slough (see Section 2.8 for additional information). The actual hydrodynamics of the slough in its post-wetlands restoration configuration are unknown, and represent a data gap with regards to the potential for deposition, erosion, or scour within the Yosemite Slough. Therefore, the EPA will require additional hydrodynamic modeling of Yosemite Slough during the design stage to better estimate net erosion potential within the Site based on the current and future projected geometries of the slough to ensure the long-term protectiveness of any response action selected for the Site.

2.7 Combined Sewer Outfalls

The SFPUC owns and operates the collection system, including outfalls, which have historically and still do, discharge to the Site under various configurations that have changed throughout the years. San Francisco is served predominantly by a combined sewer system which means both sewage and storm water are collected in the same network of pipes. On a typical dry weather day, the sewer system collects and treats more than 75 million gallons of wastewater, primarily municipal sewage throughout San Francisco. During rainy weather, by contrast, the system can capture and process up to 500 million gallons per day of combined flows citywide.

Until 1957, 100% of the combined system flows of residential/industrial sewage and the storm water, during both dry and wet weather, were discharged directly into either the Yosemite Slough or South Basin without any treatment (O'Neil 2008).

Beginning in 1955 and continuing through 1965, the City implemented a major reconfiguration of the Yosemite Basin's sewer system. In 1955, the Hunters Point sewer tunnel was constructed to transport sewer flows from this area to the Southeast Water Pollution Control plant, though it did not become fully utilized until 1957 when the Yosemite Pump Station was constructed. The Yosemite Pump Station was decommissioned in 1990 after being replaced with the Griffith Pump Station and transport system in August 1989 (O'Neil 2008; Battelle 2004).

All dry weather combined sewage and storm water flow collected from within Yosemite Basin were routed through the Hunter's Point Tunnel for treatment at the Southeast Water Pollution Control Plant. The three combined sewage outfalls

(CSOs) intermittently discharged directly into Yosemite Slough during wet weather when flows exceeded the system's capacity as follows:

- The Yosemite Avenue Outfall (CSO 41), located at the end of Yosemite Avenue at the southwest corner of the slough and head of the former Yosemite Creek historically discharged the greatest volume;

- Fitch Street Outfall (CSO 42), located close to the mouth of the Yosemite Slough on the southern shore near Fitch Street, now known as Arelious Walker Drive, historically drained the industrial properties on the southern edge of the Site, as well as the Candlestick Park area; and

- The Griffith Street Outfall (CSO 40), located near the end of Griffith Street near the middle of the slough on the northern shore, historically drained approximately 200 acres north of the Site.

These overflows of residential and industrial sewage and storm water occurred whenever precipitation exceeded only 0.02 inches per hour (O'Neil 2008). In 1983 the City conducted computer modeling, which indicated that such overflows into Yosemite Slough occurred at an average rate of 46 times per year (O'Neil 2008).

During the 1980s and 1990s, the City built underground storage vaults called transport/storage (T/S) structures to comply with the Clean Water Act (CWA) and to reduce pollution of the bay and ocean during large storms. All combined sewage and storm water flows pass into and through these structures on their way to treatment plants. During large storms, these large T/S structures fill and retain the combined wastewater and storm water for subsequent treatment. The storage boxes are also designed to provide a basic level of primary treatment allowing solids to settle and floatables to be captured prior to discharge. However, when the system capacity is exceeded, occasional overflows of the system do still occur and are discharged to Yosemite Slough.

Figure 2-1 shows the locations of the three SFPUC CSOs at the Site and Figure 2-5 shows typical features of a combined sewer and storm water structure found near Yosemite Slough.

Since the late 1980s, the City's NPDES permits under the CWA have required the construction and operation of storage, pumping, and treatment facilities sufficient to reduce discharges to Yosemite Creek from an historical average of 46 per year to "a long-term average of 1 CSO discharge and overflow to the Slough per year. In 1990, the T/S box, built along with Griffith Pump Station, went into operation. By 1991, the combined sewer collection system in the southeastern part of the City had reached its current configuration" (Battelle 2004).

2.8 Current and Future Habitats and Land Uses

Since the late 1950s, the land immediately surrounding the Site has consisted of active and abandoned former industrial or commercial operations, eroded asphalt pavement, and areas vegetated with ruderal (non-native) plants and weeds. The existence of the industrial area and unimproved areas around Yosemite Slough makes public access and use of the slough difficult and unappealing. Current human uses in and around the slough include infrequent transient encampments and occasional access to the shoreline by small boats during high tides. During lower tides, the Site is a mudflat, which makes significant human access impracticable.

Ruderal (non-native) plants and weeds that are present in areas that have not been restored by the CDPR include pampas grass (*Cortaderia* or *Erianthus*) and fennel (*Foeniculum vulgare*), in addition to non-native grasses. The dominant species of vegetation in the wetland areas adjacent areas to the Site had previously been cordgrass (*Spartina foliosa/alternaflora* [hybridized]), gumplant (*Grindelia* spp.), pickleweed (*Salicornia virginica*), and saltgrass (*Distichlis spicata*). Consistent with the non-native *Spartina* eradication project that was approved by the California State Coastal Conservancy, a control program was implemented to remove the invasive hybrid species of cordgrass in Yosemite Slough (California State Coastal Conservancy and USFWS 2003).

The CDPR broke ground on a large-scale wetland restoration work at the CPSRA in 2011. The work will ultimately result in the addition of substantial native habitat for wildlife and a buffer zone that will protect the wetlands from the surrounding urban landscape (see Figure 2-6). The design for the project increases the area of tidally influenced wetlands along the bay margin through the removal of historic bay fill. It also provides for two isolated bird nesting islands including one designed specifically for special status species, nursery areas for fish and benthic organisms, transitional and upland areas to buffer sensitive habitats, a significant new portion of the bay trail, and passive public use areas with an environmental interpretive center. The restoration design also addresses soil contaminant issues arising from previous fill activities on State Park property.

The State's wetlands project is broken into three phases (see Figure 2-7). Phase 1 on the north side of the Site is complete and vegetation maintenance is ongoing. Phase 2 on the southeast side of the Site is scheduled to commence in 2015. Phase 3 on the south-central and western sides of the Site is currently unfunded and has no schedule at this point.

The City of San Francisco together with its development partner are pursuing plans to develop approximately 700 acres in the Hunters Point Shipyard – Candlestick Point area. This mixed-use project is expected to include at full build-out approximately 10,500 homes for sale or rent, commercial retail uses, office space, public use and open space recreation along the shoreline areas. The project will be completed in phases during the next 20 years. This project also includes a proposal for the construction of a new bridge for transit, pedestrians, and bikes only over the east end of Yosemite Slough near the mouth of the Slough.

2.9 Natural Resources, Sensitive Species and Environments

The sections below provide general information on the habitats and species within and adjacent to the Site.

2.9.1 Shellfish

During sampling by the Navy at HPNS, invertebrates were observed to inhabit and forage along the Parcels E and E-2 shoreline. Invertebrates included crustacean crabs and isopods that hide under rocks and feed on other small invertebrates. Mussels (*Bivalvia*), mainly *Mytilus edulis*, and barnacles (infraclass *Cirripedia*) are visible on the rocks at low tide. At Yosemite Slough, shellfishing activities at the Site are currently limited or non-existent. Shellfish populations are expected to increase after the completion of each phase of adjacent wetland restoration areas.

2.9.2 Birds

Yosemite Slough provides nesting and foraging habitat for many seasonal birds. During a 2003-04 census of the waters and uplands of the CPSRA, performed by Golden Gate Audubon naturalists and local high school students, participants counted a large number of birds (as many as 2,347 sighted in one day) and identified 148 species overall (including 118 bird species and many other butterflies, snakes, and small mammals).[2]

Intertidal and saline emergent wetlands may be used by shorebirds and wading birds, such as the willet (*Catoptrophorus semipalmatus*), killdeer (*Charadrius vociferous*), great blue heron (*Ardea herodias*), and double-crested cormorant (*Phalacrocorax auritus*) (Tetra Tech and LFR 2000). In addition, other bird species were reported to be or are present along the shoreline, including the black-bellied plover (*Pluvialis squatarola*), black turnstone (*Arenaria melanocephala*), sanderling (*Calidris alba*), long-billed curlew (*Numenius americanus*), dunlin (*Calidris alpina*), American kestrel (*Falco sparverius*), red-tailed hawk (*Buteo jamaicensis*), and peregrine falcon (*Falco peregrinus*) (PRC Environmental Management, Inc. 1996; Tetra Tech and LFR 2000). The surf scoter (*Melanitta perspicillata*) forages in both the intertidal and off-shore areas.

California Clapper Rail

Low-intertidal to mid-tidal ranges can provide habitat for the endangered California clapper rail (CCR; *Rallus longirostris obsoletus*). The CCR is listed as endangered under both the State of California and Federal Endangered Species Acts (LSA 2009). In saline emergent wetlands, CCRs nest mostly in lower zones

[2] For more information, see the Golden Gate Audubon Society's Web site at: http://www.goldengateaudubon.org/conservation/wetlands/yosemite-creek-watershed/.

near tidal sloughs and where cordgrass is abundant. They prefer tall stands of pickleweed and Pacific cordgrass, but are also associated with gumplant, saltgrass, alkali heath (*Frankenia grandifolia*), and jaumea (*Jaumea carnosa*) in high marshes. The CCR prefers habitats containing marshes supporting tidal sloughs that provide direct tidal circulation throughout the area. They also require shallow water and mudflats with sparse vegetation and abundant invertebrate populations for foraging habitat, and escape routes from predators (Zembal and Massey 1983; Foerster et al. 1990). Although no CCR have been observed within or adjacent to the Yosemite Slough, future habitat in restored areas around and within some portions of Yosemite Slough could provide habitat for CCR. A nesting pair of CCR was discovered in August 2011 two miles away from Yosemite Slough, at Heron's Head Park (once known as Pier 98). An ecological risk evaluation of the CCR is provided in Appendix A-1.

Other Special Status Birds

Bird species of concern near the Site include the California least tern (*Sterna antillarum browni*) the California brown pelican (*Pelecanus occidentalis*), and the American peregrine falcon (*Falco peregrines anatum*) (Navy 2008, Navy 2011). The California least tern is both a state and federally listed endangered species. The California brown pelican is state listed endangered species. The American peregrine falcon is currently identified as a candidate species for delisting for the state of California endangered and threatened species list; this species was delisted as a federal endangered species in 1999 (Navy 2011).

2.9.3 Fish

During the fish sampling conducted as part of the Navy's *Final HPS Parcel F Validation Study* (Battelle and Neptune & Co. 2005), several species of fish were encountered, including several species of goby, smelt and surfperch, staghorn sculpin (*Leptocottus armatus*), cabezon (*Scorpaenichthys marmoratus*), English sole (*Parophrys vetulus*), speckled sanddab (*Citharichthys stigmaeus*), crevice kelpfish (*Gibbonsia montereyensis*), bay pipefish (*Syngnathus leptorhynchus*), plainfin midshipman (*Porichthys notatus*), chinook salmon (*Oncorhynchus tshawytscha*), Pacific herring (*Clupea harengus*), leopard shark (*Triakis semifasciata*), Pacific sardine (*Sardinops sagax caeruleus*), and northern anchovy (*Engraulis mordax*).

Green Sturgeon

In October 2009, the National Marine Fisheries Service (NMFS) announced critical habitat for the threatened green sturgeon *(Acipenser medirostris)* to include the San Francisco Bay. The green sturgeon is an anadromous fish that lives primarily in the sea and breeds in fresh water. The green sturgeon is believed to spend the majority of its life in nearshore oceanic waters, bays, and estuaries. The only feeding data available for the adult green sturgeon shows that it consumes "benthic" invertebrates including shrimp, mollusks, amphipods, and even small fish (Moyle et al. 1992). Adults live in oceanic waters, bays, and estuaries when not spawning. The green sturgeon is known to forage in estuaries and bays ranging from San Francisco Bay to British Columbia. An ecological risk evaluation of the Green Sturgeon is provided in Appendix A-2.

2.9.4 Mammals

Mammals observed along the upland and shoreline areas near the Site include California ground squirrels (*Spermophilus beecheyi*) and other small mammals, which could forage and use the areas adjacent to Yosemite Slough for burrows. In October 2001, an almost complete skeleton of a large male raccoon (*Procyon lotor*) was found along the shoreline of the Parcel E-2 Panhandle Area of the HPNS. In addition, the house mouse (*Mus musculus*) is expected to use the shoreline, especially in the Panhandle Area (Tetra Tech and LFR 2000). Mammals are not expected to significantly use or forage within the Site itself.

Salt Marsh Harvest Mouse

To date, the salt marsh harvest mouse (*Reithrodontomys raviventris)* has not been observed at or near the Site. The closest population of salt marsh harvest mouse is located in San Mateo County. There is approximately 19 miles of shoreline between that population and Yosemite Slough. Because existing populations of this mouse are significantly geographically isolated from the Site, it is not likely that the salt marsh harvest mouse will be able to migrate to and inhabit the restored wetland areas adjacent to the Site.

2.10 Current and Potential State and Federally Listed Species at Yosemite Slough

Several special status plant and animal species have been documented to occur, or potentially occur, in southern San Francisco and northern San Mateo counties. However, a search of the California Department of Fish and Game Natural Diversity Data Base found no documented occurrences of special status species within the Site. Two special status species may occasionally forage within subtidal and intertidal areas of the Site: the California brown pelican and double-crested cormorant. However, these two birds do not nest within or adjacent to the Site. Based on existing habitat conditions, there is a low potential for occurrence on the Site for other special status animals; however, due to isolation from other similar habitats and the proximity of human activity, these species probably do not occur on the Site. Similarly, special status plant species are not expected to occur on the Site because of complete habitat conversion during the last century, resulting in the dominance of non-native invasive plant species (WRA, Inc. 2002). Wildlife surveys conducted by the Golden Gate Audubon Society in 2003 and 2004 also did not find any special status plant and animal species within the Site (LSA 2004).

With respect to potential, future state and federally listed threatened or endangered species, the CCR and green sturgeon were retained for further consideration. A detailed evaluation of potential risks to CCR and green sturgeon is provided in Appendix A. As stated above, the salt marsh harvest mouse is not at or near the Site and there is no nearby salt marsh harvest mouse population that could migrate to the Site. Therefore, salt marsh harvest mouse does not need any further evaluation for potential future risk at the Site.

2.11 Site History and Cultural Resources

It has been estimated that many thousand Native Americans inhabited the San Francisco Bay Region prior to European contact. With its supplies of fresh water from several dozen streams and artesian springs, combined with its relatively wind and fog-free climate and marshlands, the area around the Site supported at least one permanent Ohlone settlement, as well as several seasonal hunting and fishing camps. Several middens, or shellmounds (heaps of discarded shells, human remains, stone arrowheads, mortars and pestles for the grinding of grain and acorns, and large stone sinkers used in fishing) were known to have existed on the shoreline of the peninsula, giving Hunters Point its first European era name, Punta de la Concha, or “Point of the Shells.” (Chavez 2001)

The first known European explorers to encounter San Francisco Bay arrived by land in 1769 under the leadership of Don Gaspar de Portolá, an agent of the Visitador General of Spain in Mexico City. Most of the indigenous Ohlone who had once thrived there had been driven off by enemies prior to the arrival of the Spanish. During the Mexican period (1821 to 1848), what is now the Bayview-Hunters Point district became part of the historic Rancho Rincon de las Salinas y Potrero Viejo, a vast ranch that occupied southeastern San Francisco. The ranch belonged to a man named Don José Cornelio Bernal. Aside from the livestock pens (corrals), there is no evidence that Bernal built any permanent, or even temporary, structures on his ranch. (Chavez 2001)

In 1827, a British expedition commanded by Captain William Beechy arrived on the ship HMS *Blossom*. Captain Beechy’s chart of San Francisco Bay – the first to survey the coastline in detail – mislabeled Punta de la Concha as Point Avisadera, a name that remained on later English and American charts for the next three decades. John Hunter started a dairy and vegetable farm on a smaller tract that he had purchased from Bernal on the south side of the peninsula, near what is now the corner of Fitch Street and Oakdale Avenue. No aboveground resources from the Hunter period of occupation are known to exist within Bayview-Hunters Point district.

During the 1860s to 1880s, Nevada mining millionaire George Hearst and other investors financed the construction of Bay View Park, a horse racing track, hotel, and stables on a low-lying tract of marshland located south of the Hunters Point peninsula, in what is now the Bayview/South Basin area. Although dikes enclosed the racecourse, the interior of the track was not filled and what became known as Yosemite Slough continued to exist within the inner oval of the track. By the early 1880s, the hotel had burned and the race course abandoned to the tides that breached the dikes. (Chavez 2001)

During the late 1800s and early 1900s, at least four piers were built along the South Basin shoreline. The first was likely a 200-foot pier southeast from the foot of Thomas Avenue just below Griffith Avenue. Prior to the first railroad in the area, the Thomas Avenue Pier (1860s through 1890s) was probably used at high tide when transporting dairy products, livestock, and agricultural produce to San Francisco. A second, shorter pier was situated northeast of present-day Carroll Avenue, between Griffith Street and the Giants Drive alignment. Projecting southeast into the bay, the Carroll Avenue Pier (1870s through 1890s) extended from a large, shoreline structure. Dominating South Basin area was the 480-foot-high Bay View Hill. For decades cattle grazed around its lower slopes. Along the dirt roadways and in the open space surrounding Bay View Hill and the Bay View Park were scattered dwellings, small businesses, horse corrals, cow and sheep pastures, and dairies. In the 1890s and early 1900s, Chinese shrimp camps were located along San Francisco Bay. In 1910, there were two shrimp camps on the south side of Hunters Point. Except for a small cove north of Thomas Avenue that was filled in the early 1880s, the natural shoreline south of Hunters Point remained largely unchanged until the late 1930s (Dow 1973, Chavez 2001). A time series of available aerial photographs of the Yosemite Slough area is presented in Appendix B.

The most significant reclamation projects in the Bay View area consisted of the World War II-era filling of the marshlands of Yosemite Slough southeast of Jennings, between Thomas and Carroll avenues. Once the land had been brought to city grade, 500 pre-fabricated dwellings were assembled on the newly created land as housing for the HPNS workers and their families. Following the war, during the late 1940s and early 1950s, the small hills above Thomas Avenue Pier and the Carroll Avenue Pier were cut back and used to fill the tidelands, moving the shoreline farther to the east (Dow 1973).

Construction of the stadium at Candlestick Point took place between 1958 and 1959. Significant volumes of soil and rock were removed from the eastern and northern slopes of Bay View Hill and placed into offshore waters (South Basin). The stadium accommodates 42,500 spectators and has an 8,000-car parking lot. In 1974, California State purchased a parcel in South Basin, northeast of the stadium and designated the parcel as the CPSRA, California's first urban state park. The state gradually acquired more land on Candlestick Point, and in 1978 the state acquired a narrow strip of land surrounding Yosemite Slough. In 1978, ground-breaking began on park facilities out on the point.

In accordance with Section 106 of the National Historic Preservation Act (NHPA), the EPA commenced a formal consultation process with Native American stakeholders identified for San Francisco County by the Native American Heritage Council concerning future ground-disturbing activities that may be associated with potential cleanup actions at Yosemite Slough. A formal consultation meeting with Native American stakeholders occurred on August 31, 2012. This consultation process will continue if requested by Native American stakeholders. The EPA will continue its compliance efforts in accordance with NHPA Section 106 during the design stage for this project.

2.12 Meteorology

San Francisco's Mediterranean climate is strongly influenced by the cool currents of the Pacific Ocean, which moderates temperature swings and produces a mild year-round climate with little seasonal temperature variation. However, because of its sharp topography and maritime influences, San Francisco exhibits a multitude of distinct microclimates.

San Francisco County's coldest month is January when the average temperature overnight is 46.4 degrees Fahrenheit (°F). In September, the warmest month, the average day-time temperature rises to 71.3°F. Among major cities in the United States, San Francisco has the coldest daily mean, maximum, and minimum temperatures for June, July, and August[3]. Temperatures exceed 75°F (24 degrees Celsius [°C]) on average only 28 days a year. Most of the annual precipitation falls between November and April. On average, there are 67 rainy days a year, and annual precipitation averages 20.4 inches (518 millimeters). Snow is extraordinarily rare, with only 10 instances recorded since 1852, most recently in 1976.

Hunters Point and Candlestick Point are known to be windy locations. Wind conditions at Candlestick Point and Hunters Point are influenced by the presence of the Bayview Hill and Hunters Point Hill, both of which are directly upwind of the Site for prevailing westerly winds. These hills tend to accelerate the wind and change its direction from west towards west-northwest, resulting in eddying (a circular motion of wind that interrupts the flow and causes turbulence), resulting in gustiness (wind speeds that momentarily increase in speed). Wind patterns at San Francisco International Airport indicate that the dominant wind direction is west-northwest, with winds coming out of this direction 23% of the time. Two-thirds of winds from this direction exceed 12 miles per hour. Winds come from directly west and northwest 13% of the time each, so that these three wind directions (west, northwest, and west-northwest) account for roughly half of the wind patterns. It is important to note that the dominant wind direction is known to shift with locations around the bay, including at Yosemite Slough. Winds can fluctuate greatly depending on the time of year and the time of day. During the winter months winds change markedly, becoming milder and less dominated by the west-northwesterly winds. Winds also change significantly during the day, typically intensifying from late morning until reaching an average peak of 20 knots (23 miles per hour) in the late afternoon, diminishing in the evening. High winds in the San Francisco Bay are most common in the late afternoon between March and October.

[3] For more information on San Francisco's weather, visit:
http://www.webcitation.org/5rVdBgvSs.
http://www.weatherbase.com/weather/weather.php3?s=149427&refer=
http://ggweather.com/sf/snow.html

2.13 Previous Investigations

Since the late 1990s, several investigations of Site sediments have been carried out as follows:

- **1995 Water Board Study.** Sediments at the Site were investigated in December 1995 under the Bay Protection and Toxic Cleanup Program (BPTCP), *Proposed Regional Toxic Hot Spot Cleanup Plan* (RWQCB 1997a).

- **1996 Navy Study of HPNS Parcel F**. As a part of ongoing CERCLA Navy remedial activities at HPNS, a remedial investigation and feasibility study was performed in 1996 at Parcel F, the portion of HPNS that includes the South Basin (Barajas & Associates, Inc. 2008). Sediment samples were collected in the South Basin and in limited number from the far eastern portion of Site.

- **1999 SFPUC Study.** *Sediment Investigation at Yosemite Creek* report by Arthur D. Little, Inc., dated May 1999. This report presents the results of sediment investigation at the Site conducted from March 1998 through May 1999. The purpose of this report is to document the results of sediment investigation to assess potential contamination and associated toxicity of surficial sediments of Yosemite Slough.

- **2004 SFPUC Study.** *Sediment Investigation at Yosemite Creek* report by Battelle dated May 5, 2004. Additional investigation and sampling of the Site was performed under the direction of the SFPUC in October 1998, October 1999, and April 2000. This investigation included the collection of surface and subsurface sediment samples up to 4 feet below ground surface, as well as bioassays and bioaccumulation in clam tissue.

- **2005 Hydrodynamic Study.** *Hydrodynamic Modeling, Wave Analysis and Sedimentation Evaluation* report by Noble Consultants, Inc. dated September 2005. Field data, including a bathymetric survey, hydrologic data collection, and surface sediment collection, were used to predict sediment dynamics for the Slough, South Basin, and wetland restoration areas.

- **2009 EPA Study.** *Yosemite Creek Sediment Removal Assessment Report dated May 2011 and Estimation of Aroclor 1254 and Aroclor 1260 Using PCB Congener Data in Yosemite Slough Sediment Sample Data from the Yosemite Creek Sediment Removal Assessment Report dated June 2012.* Between June 17 and July 9, 2009, EPA's consultant, E & E, assisted the EPA with the collection of 191 sediment samples from 36 sampling locations at the Site.

The analytical data from the above-referenced data reports are provided in Appendix C and further discussed in Section 3.

Additional Technical Studies of 2011-2012

In 2011-2012, EPA (in cooperation with several Site potentially responsible parties), undertook three technical studies that the EPA decided were necessary to address data gaps in order to prepare this EE/CA report. These technical studies are summarized below. The analytical data from these technical studies are included in Appendix C. In addition, these additional technical studies are presented electronically as Appendix D.

Waste Classification Study

On February 21, 2012, the EPA collected a total of 32 samples from eight sample locations during the waste characterization study performed by an EPA contractor, Ecology and Environment, Inc. (E & E 2012). Samples were taken from target depths ranging from 1 to 4 feet below sediment surface (BSS) and analyzed for PCBs as Aroclors, metals, hexavalent chromium, and asbestos. PCBs were not observed at concentrations exceeding the Toxic Substances Control Act (TSCA) regulatory limit of 50 milligrams per kilogram (mg/kg) for total PCBs as a sum of Aroclors in any sample from this study, which indicate that the sediments are unlikely to be TSCA-regulated waste for purposes of disposal.

Test results for soluble metals and total metals indicated that both lead and chromium were present in Yosemite Slough sediments at concentrations that exceed their respective disposal regulations for the state of California. These metals test results also indicate that sediment may be classified by the state of California as hazardous waste but non-Resource Conservation and Recovery Act (RCRA) waste for purposes of disposal. Furthermore, because the results of this waste characterization study show a good correlation between existing total threshold limit concentrations (TTLC) and soluble threshold limit concentrations (STLC) data sets, extrapolations regarding disposal classification volumes and area can be made using the 2009 remedial assessment sampling results and the 2012 waste characterization study results (E & E 2012).

Geotechnical Study

Between March 15 and March 23, 2012, ARCADIS (technical consultant to Beveridge and Diamond, P.C. on behalf of a group of PRPs) performed a geotechnical study in Yosemite Slough and South Basin (ARCADIS 2012). Six geotechnical borings were drilled to depths ranging from 36 to 87 feet BSS and included standard penetration testing/split-spoon sampling. Fourteen split-spoon samples were analyzed for one or more index property and classification tests including moisture content, bulk density, grain size, Atterberg limits, and specific gravity. Fifteen relatively undisturbed Shelby tube samples were collected from three of the borings. Shelby tube samples were submitted for advanced geotechnical laboratory testing, including unconsolidated, undrained, triaxial compressive shear strength testing and consolidation testing. Vane shear testing (VST) was performed at three locations to measure undrained shear strength. The VSTs were co-located with the three geotechnical borings that included Shelby tube sampling. Rock coring was performed in one boring where bedrock was encountered at 20.6 feet BSS and the boring was terminated at a depth of 36 feet BSS. Bedrock was encountered in one other boring at a depth of 71.5 feet BSS, but the rock quality was poor and the boring was terminated at 87 feet BSS using the mud rotary bit. At the remaining locations, the bedrock surface was deeper than anticipated and the borings were terminated prior to encountering bedrock (60.5 to 96.5 feet BSS). The geotechnical study identified four primary geologic units: Young Bay Mud (soft clay), Older Bay Sediments (sand), Older Bay Sediments (clay), and Sandstone Bedrock (Franciscan complex).

Sediment Dewatering Treatability Study

A sediment treatability study was conducted by NewFields LLC (NewFields), technical consultant to SFPUC, to support the development of this EE/CA. The treatability study scope was described in the "Workplan to Perform Sediment Treatability Study Yosemite Slough Sediment Area" (NewFields 2012a). The study consisted of sample collection, laboratory analysis, and bench-scale treatability tests. Results and analysis of the data were presented in the "DRAFT Sediment Treatability Study for Yosemite Slough Sediment Area" (NewFields 2012b).

Bulk sediment samples were collected from four locations. Multiple cores were collected at each location to provide adequate volume and were homogenized to create four treatability sediment composites representative of the four sample locations. The four sample locations were collocated with EPA's waste characterization samples. Surface water was collected from the Site for use in treatability testing. Aliquots of the sediment composite and surface water were analyzed to determine the baseline physical (sediment only) and chemical characteristics.

A series of bench-scale tests were conducted to provide data to evaluate the potential effects of dredging on surface water and effectiveness of potential dewatering technologies. The bench-scale treatability tests included the following:

- Four dredging elutriate tests (DRETs), including laboratory analysis of elutriate to evaluate potential resuspension and release of contaminants during dredging and dewatering tests:
  - Chemical additive (e.g., polymer) jar testing to evaluate chemicals for use in dewatering processes,
  - Twelve geotextile rapid dewatering tests and three hanging bag geotextile dewatering tests to evaluate dewatering using geotextile tubes and decant water quality from geotextile tubes, and
  - Plate and frame filter press dewatering tests to evaluate dewatering using filter presses and decant water quality from filter presses.

2.14 Previous Removal Actions

No prior removal or other cleanup actions have addressed contamination within the boundaries of the Site to date. As part of its wetlands restoration project at

Yosemite Slough, the CDPR is identifyng and addressing contamination on State Parks property adjacent to the Site pursuant to the California Regional Water Quality Control Board Order Number R2-2007-0046 dated July 11, 2011 (RWQCB 2011).

02:002693.7008.02TTO\Fig2-1 GE May2011.ai-GRA

Site Boundary

N

Figure 2-1
May 2011 Aerial Photograph
Yosemite Slough
San Francisco, California

Figure 2-2
July 1938 Aerial Photograph

Yosemite Slough
San Francisco, California

Figure provided by EPA Region 9

02:002693.7008.02TTO\Fig2-3 GE August 2012.ai-GRA

Site Boundary

N

Figure 2-3
August 2012 Aerial Photograph
Yosemite Slough
San Francisco, California

02:002693.7008.02TTO-B3681\Fig 2-4 Oblique Aerial.ai-GRA-07/09/13

Source: Aerialsondemand.com, courtesy of Top Grade Construction

Figure 2-4 Yosemite Slough Site at High Tide

02:002693.7008.02TTO-B3681\Fig 2-5 CSO Features.ai-GRA-07/09/13

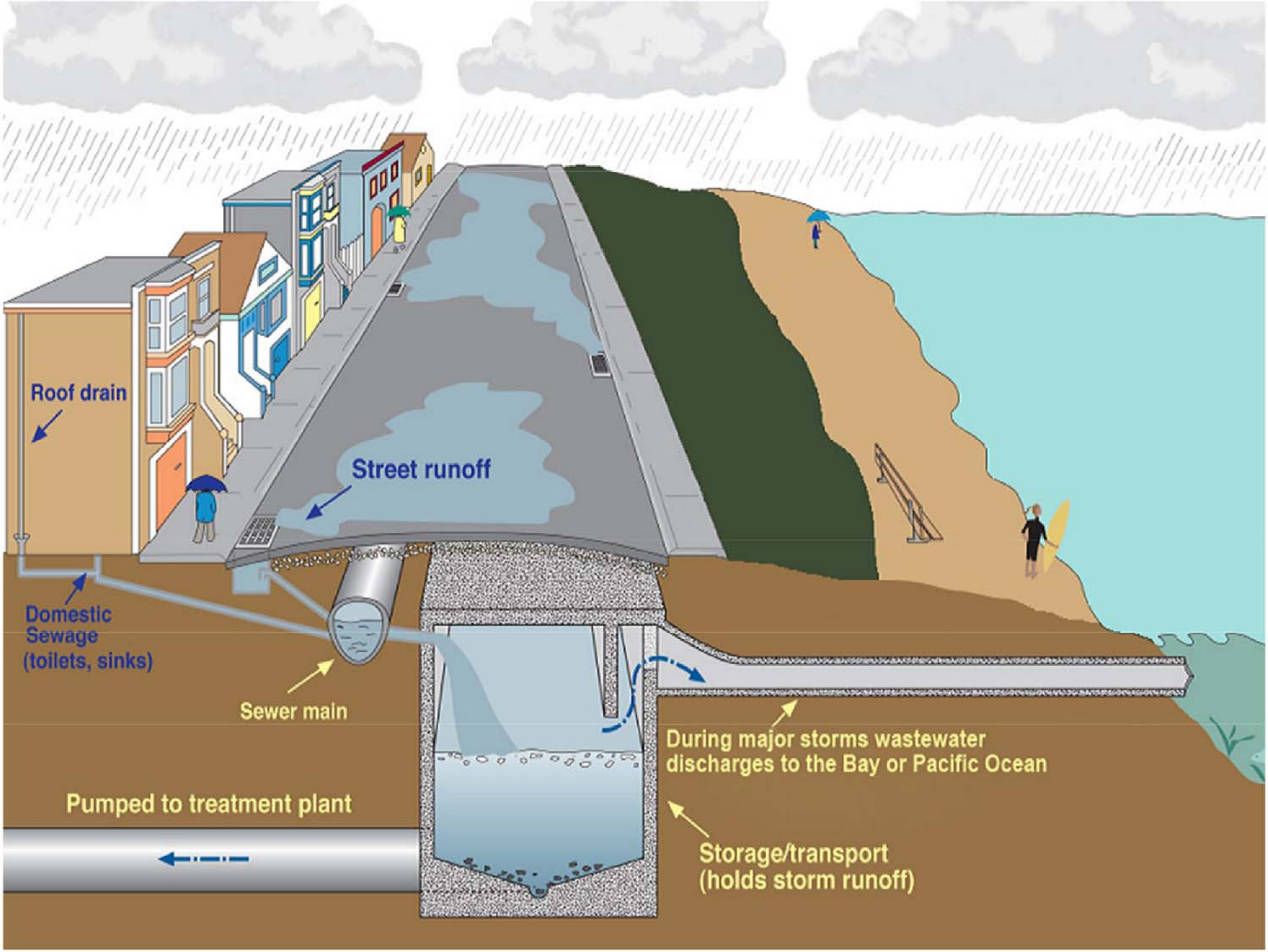


Figure 2-5 CSO Features

02:002693.7008.02TTO-B3681\Fig 2-6.ai-GRA-07/09/13

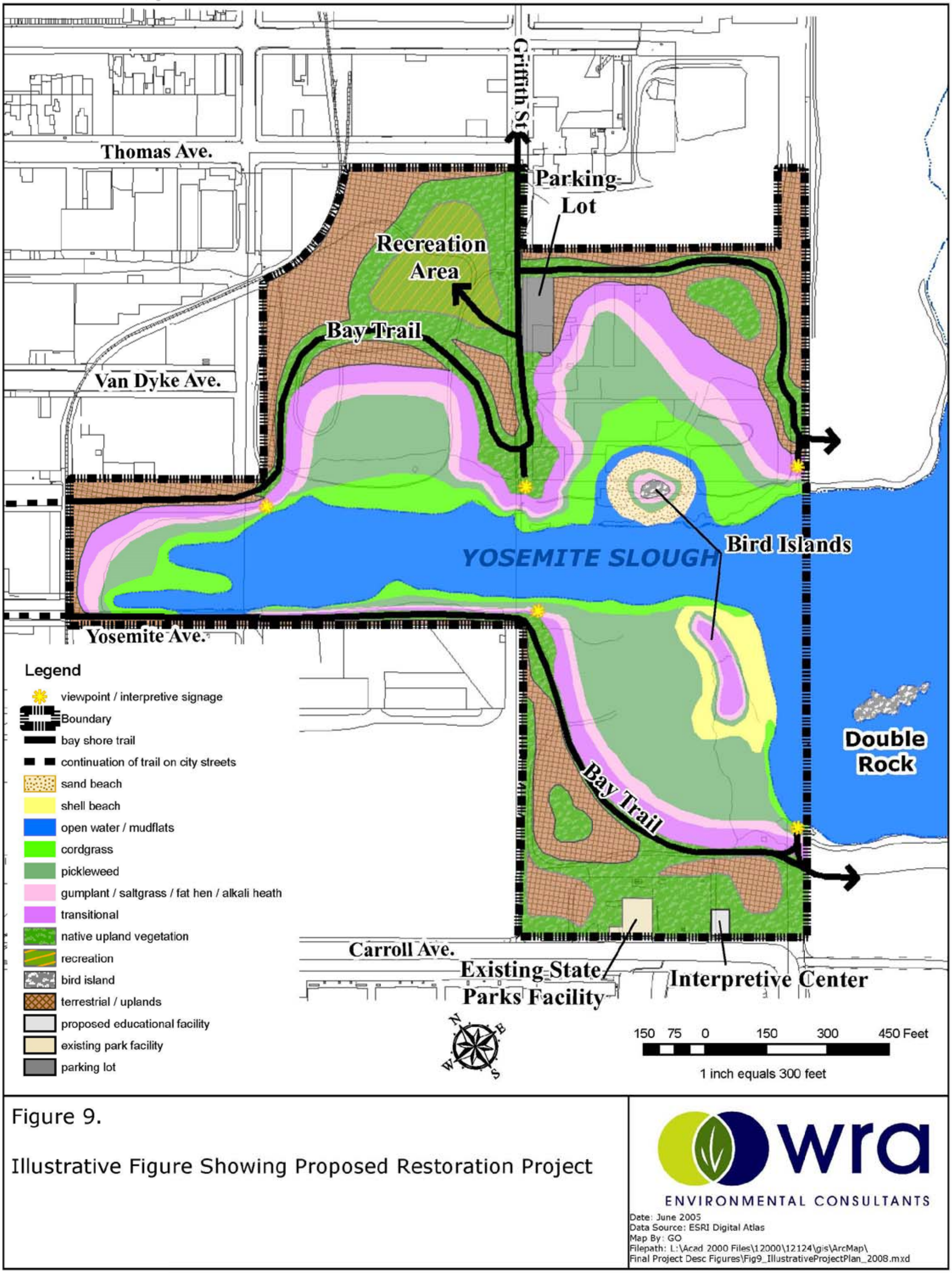


Figure 2-6 Yosemite Slough Restoration Plan (from WRA, 2006)

Figure 2-7
Candlestick Point
State Recreation Area Wetlands
Restoration by Project Phase

Yosemite Slough
San Francisco, California

Figure provided by EPA Region 9
Image © 2013 Google

3 Source, Nature, and Extent of Contamination

3.1 Sources of Contamination

The primary sources of contaminated sediments at the Site likely originated throughout the broader Yosemite Creek Basin watershed and could include the following:

- Industrial activities in the Yosemite Creek drainage basin, which produced sediments that were transported to the Yosemite Slough by way of the combined storm and sewer system;
- Non-native fill material placed along the Yosemite Slough banks and which may have been placed directly in the Slough during the late 1940s and 1950s, which erode into the Slough;
- Potential undocumented commercial and industrial discharges directly into Yosemite Slough;
- Urban runoff of storm water discharging directly into Yosemite Slough;
- Groundwater transport of contaminants into Yosemite Slough;
- Atmospheric deposition of contaminants into Yosemite Slough;
- Regular flooding of both Armstrong and Griffith pump stations at high tide flowing back into the bay; and
- Release of contamination from materials placed during filling and/or development activities.

From the late 1930s to the early 1970s, portions of the San Francisco Bay adjacent to the Site have undergone three phases of significant filling with soil, rock, and debris.

- U.S. Navy's Hunter Point Naval Shipyard Fill Placement (1939 to 1945);
- Construction of Candlestick Stadium and parking lots (1950s to 1960s); and

- South Basin Fill Placement (mid-1950s to early 1970s).

3.2 Upland Source Control of Contaminants

Source control generally is defined as the efforts taken to eliminate or reduce, to the extent practicable, the release of contaminants from direct and indirect continuing sources to the water body (EPA 2005). Even after the original or most significant contributors of contamination have been controlled, other sources may continue to introduce contamination to the Site. Land under control of the CSLC and CDPR located within the CPSRA and adjacent to the Site is now undergoing cleanup and restoration by the CDPR. This project is called the Yosemite Slough Wetlands Restoration Project and is being overseen by the California Regional Water Quality Control Board pursuant to Order Number R2-2007-0046. However, additional upland contamination risks to the Site remain and need to be addressed in order to ensure long-term success of the response action at the Site.

Reasonable upland source controls efforts underway or under consideration for the Site include:

- The California State Parks on-going wetlands restoration project for Yosemite Slough uses removal of contaminated soil from Slough-adjacent areas and specific placement of cleanup soils to facilitate upland and tidal wetland plant growth;

- Slough bank stabilization to prevent further erosion on non-native fill material into Yosemite Slough;

- Development of storm water management plans for properties in proximity to Yosemite Slough to ensure overland urban storm water flows do not enter the Yosemite Slough and are instead directed to SFPUC storm drains or are treated by green infrastructure and best management practices (e.g., bioswales) before reaching Yosemite Slough;

- Continued SFPUC enforcement of sewer industrial pre-treatment rules prior to any sewer discharges;

- Continued SFPUC management of storm water on city streets;

- The SFPUC-lead efforts to promote proper storm water management on private parcels and streets not owned or managed by the City; and

- Collaborative efforts to prevent illicit dumping of trash and waste materials near or in Yosemite Slough. These collaborative efforts may include resources from City of San Francisco agencies, the CDPR, local non-profit agencies, and local community members. Community members could provide educational information about ecological, recreational, and public health benefits of a restored Yosemite Slough, the actions to protect slough quality and through surveillance and prevention of illicit dumping near or in Yosemite Slough.

3.3 Description of Contaminated Material

Contaminants of potential concern (COPCs) are those contaminants that are present at elevated levels and have the potential to pose a risk. Chemicals of concern (COCs) are those contaminants that are most dominant, widespread, and constitute the major sources of risk to human health and environment. The sections below describe the available Site data and evaluate that data to identify the COPCs and COCs for the Site. Figure 3-1 summarizes the COPC and COC selection process.

3.3.1 Analytical Data

The analytical data used in the evaluation of COPCs and COCs at Yosemite Slough have been incorporated into a Microsoft Access® database. The database is included on a Compact Disk and attached to this report as Appendix E. Historical data included in the database were obtained from the following reports:

- Arthur D. Little, Inc. (1999);
- Battelle (2004);
- E & E (2011);
- E & E (2012);
- ARCADIS (2012); and
- NewFields (2012a).

Other available historical data (e.g., BPTCP 1995) were not included in the database due to the age of the data and subsequent data reports were significantly more comprehensive.

Chemicals detected in sediment samples collected from Yosemite Slough through the studies listed above are provided in Table 3-1. The locations of samples collected at the Site are shown on Figure 3-2. The analytical data from those sediment samples are presented in Appendix C. The following statistics for all COPCs were calculated and provided in Tables 3-1 and/or 3-2:

- Frequency of detection;

- The 95% upper confidence limit (UCL) of the mean is defined as the 95% upper confidence limit on the average as calculated using ProUCL 4.1 (EPA 2010); and

- Range of detections (minimum, maximum) for all data and maximum of more recent data (2009 to present).

Table 3-1 Identification of Chemicals of Potential Concern

	Units:	Count	Number of Detects	Number of Non-detects	FOD	Min	Max	95% UCL	Ambient Value	Ref	COPC?	Justification
METALS												
Aluminum	mg/k	46	46	0	100	9,499	50,725	39,287	61,155	SFEI	No	Below ambient
Antimony	mg/k	16	5	11	31	2.1	9.4	3.9	NA		No	No ambient data; unlikely to be risk
Arsenic	mg/k	62	62	0	100	3.4	13	10	15.3	RWQCB	No	below ambient
Barium	mg/k	16	16	0	100	36	720	279	NA		No	No ambient data; unlikely to be risk
Beryllium	mg/k	16	16	0	100	0.23	0.70	0.51	NA		No	No ambient data; unlikely to be risk
Cadmium	mg/k	62	61	1	98	0.36	10	3.4	0.33	RWQCB	**Yes**	
Chromium	mg/k	225	225	0	100	18	796	160	112	RWQCB	**Yes**	
Cobalt	mg/k	16	16	0	100	7	17	13	NA		No	No ambient data; unlikely to be risk
Copper	mg/k	62	62	0	100	15	445	138	68.1	RWQCB	**Yes**	
Iron	mg/k	46	46	0	100	15,918	52,433	40,554	63,254	SFEI	No	Below ambient
Lead	mg/k	225	225	0	100	2	2,800	367	43.2	RWQCB	**Yes**	
Mercury	mg/k	225	218	7	97	0	1.9	0.57	0.47	SFEI	**Yes**	
Molybdenum	mg/k	16	1	15	6	--	--	--	NA		No	No ambient data; low FOD
Nickel	mg/k	62	62	0	100	29	160	89	112	RWQCB	No	Below ambient
Selenium	mg/k	62	44	18	71	0	2.4	0.6	0.64	RWQCB	No	At ambient
Silver	mg/k	62	44	18	71	0	24.8	2.0	0.58	RWQCB	**Yes**	
Vanadium	mg/k	16	16	0	100	49	99	77	NA		No	No ambient data; unlikely to be risk
Zinc	mg/k	225	225	0	100	21	1,490	367	158	RWQCB	**Yes**	
TOTAL PETROLEUM HYDROCARBONS (TPH)												
TPH (diesel range organics)	mg/k	166	137	29	83	7	5,900	429	NA		**Yes**	No ambient data; could be risk driver
TPH (motor oil range organics)	mg/k	163	132	31	81	17	6,100	881	NA		**Yes**	No ambient data; could be risk driver
TPH (gasoline range organics)	ug/kg	162	43	119	27	460	23,000	2,022	NA		**Yes**	No ambient data; could be risk driver
POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)												
Total PAHs	ug/kg	43	43	0	100	3,679	55,787	14,150	4,735	SFEI	**Yes**	
PESTICIDES												
Aldrin	ug/kg	46	4	42	9	0	1.8	0.6	0.4	SFEI	**Yes**	
Total Chlordane (4	ug/kg	209	43	166	21	4	208	17	1.1	RWQCB	**Yes**	
DDT (total)	ug/kg	209	45	164	22	9	1,430	43	7.0	RWQCB	**Yes**	
Dieldrin	ug/kg	209	43	166	21	4	370	20	0.4	RWQCB	**Yes**	
Heptachlor	ug/kg	46	19	27	41	0	1.70	0.53	0.2	SFEI	**Yes**	
alpha-HCH	ug/kg	19	7	12	37	0	0.28	0.12	0.8	RWQCB	No	Below ambient
gamma-HCH (lindane)	ug/kg	46	8	38	17	0	0.68	0.17	0.8	RWQCB	No	Below ambient
POLYCHLORINATED BIPHENYLS (PCBs)												
Total PCBs (18 congeners)	ug/kg	209	197	12	94	0	34,900	3,307	26.4	SFEI	**Yes**	
Total PCBs (Aroclors)	ug/kg	209	173	36	83	42	130,000	11,486	26.4	SFEI	**Yes**	

Notes:
FOD = Frequency of Detection
95% UCL = 95 percent upper confidence limit on the average concentration
SFEI = San Francisco Estuary Institute (2012)
RWQCB = San Francisco Regional Water Quality Control Board (1997b)
HCH = Hexachlorocyclohexane
DDT = Dichlorodiphenyltrichloroethane
mg/kg = milligrams per kilogram, or parts per million, ppm
ug/kg = micrograms per kilogram, or parts per billion, ppb

Table 3-2 Identification of Chemicals of Concern

COPCs	Units:	Max (all data)	95% UCL	Screening Value	Ref	Maximum Site Concentration (2009-2012)	COC?	Justification
METALS								
Cadmium	mg/kg	10	3.4	10	ERM	--	No	95%UCL less than screening
Chromium	mg/kg	796	160	370	ERM	--	No	95%UCL less than screening
Copper	mg/kg	445	138	270	ERM	--	No	95%UCL less than screening
Lead	mg/kg	2,800	367	218	ERM	2,800	**Yes**	
Mercury	mg/kg	1.9	0.57	1.9	Navy Parcel F	--	No	95%UCL less than screening
Silver	mg/kg	24.8	2.0	3.7	ERM	--	No	95%UCL less than screening
Zinc	mg/kg	1,490	367	410	ERM	--	No	95%UCL less than screening
TOTAL PETROLEUM HYDROCARBONS (TPH)								
TPH-d	mg/kg	5,900	429	500	RWQCB ESL	--	No	95%UCL less than screening
TPH-mo	mg/kg	6,100	881	2,500	RWQCB ESL	--	No	95%UCL less than screening
TPH-g	ug/kg	23,000	2,022	500,000	RWQCB ESL	--	No	95%UCL less than screening
POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)								
Total PAHs	ug/kg	55,787	14,150	44,792	ERM	--	No	95%UCL less than screening
PESTICIDES								
Aldrin	ug/kg	1.8	0.6	140	NOAA	--	No	95%UCL less than screening
Total Chlordane (4	ug/kg	208	17	6.0	ERM	ND	No	Recent data is ND
Total DDTs	ug/kg	1,430	43	46	ERM	--	No	95%UCL less than screening
Dieldrin	ug/kg	370	20	8	ERM	ND	No	Recent data is ND
Heptachlor	ug/kg	1.70	0.53	0.3	NOAA	ND	No	Recent data is ND
POLYCHLORINATED BIPHENYLS (PCBs)								
Total PCBs (18 congeners)	ug/kg	34,900	3,307	1,240.0	Navy Parcel F	34,900	**Yes**	
Total PCBs (Aroclors)	ug/kg	130,000	11,486	1,240.0	Navy Parcel F	130,000	**Yes**	

Notes:

COPC = Constituent of potential concern.

95% UCL = 95 percent upper confidence limit on the average concentration

COC = Constituent of concern.

References:

ERM = Effects Range Median (RWQCB 1997b)

Navy Parcel F = Battelle, Blasland Bouck & Lee, Inc. and Neptune & Co. 2005

RWQCB ESL = Environmental Screening Levels (RWQCB 1997b)

NOAA SQuiRTs = NOAA Screening Quick Reference Tables (http://response.restoration.noaa.gov/cpr/sediment/squirt/squirt.html)

3.3.2 COPC Selection

The COPCs were selected based on an evaluation of the frequency of detection and a comparison of analytical results for samples collected at the Site to ambient levels. The ambient levels used are as follows, in order of preference:

- San Francisco Bay ambient thresholds established by the San Francisco Estuary Institute (SFEI) for dredged material (SFEI 2012); and
- San Francisco Bay ambient concentrations established by the San Francisco Bay Regional Water Quality Control Board (RWQCB) (RWQCB 1997b).

Constituents that are identified as COPCs in Table 3-1 include metals (cadmium, chromium, copper, lead, mercury, silver and zinc), total petroleum hydrocarbons, total polychlorinated aromatic hydrocarbons, pesticides (aldrin, chlordanes, dichlorodiphenyltrichloroethanes, dieldrin, and heptachlor), and PCBs.

Metals including lead, nickel, copper, chromium, and zinc have been detected at the Site. Soils derived from Franciscan bedrock, such as those at the Site, are known to contain higher concentrations of chromium and nickel than soils developed from other rock types. Fine-grained clay particles and aluminosilicate minerals are other natural sources of metals to San Francisco Bay.

The term "PCB" refers to a group of 209 different homologs, called PCB congeners, sharing a similar structure consisting of two benzene rings bonded to varying numbers of chlorine and hydrogen atoms (EPA 2005). PCBs were widely used in manufacturing of adhesives, caulking compounds, as additives to hydraulic fluids, paints, plastics, and most commonly as insulators in electrical transformers and capacitors (Arthur D. Little, Inc. 1999). Aroclors are one of the most well-known commercial mixtures of PCB congeners. Monsanto Corporation, the major U.S. producer of PCBs from 1930 to 1977, marketed mixtures of PCBs under the trade name Aroclor. The Aroclors are identified by a four-digit numbering code in which the first two digits indicate the type of mixture and the last two digits indicate the approximate chlorine content by weight percent. Thus, Aroclor 1242 is a chlorinated biphenyl mixture of varying amounts of mono- through heptachlorinated homologs with an average chlorine content of 42% (ATSDR 2000).

Weathering of an Aroclor after release into the environment results in a change in its congener composition (EPA 2005). In general, less chlorinated PCBs bioaccumulate less than the highly chlorinated congeners, but are more soluble and, therefore, more readily transported into and within the water column than more highly chlorinated PCBs (EPA 2005).

Quantification of PCBs in environmental media is complicated, since the relative concentration of congeners changes over time due to weathering and decomposition in the environment. In addition, since the quantification of all 209 congeners within a sample is not practical, analytical methods have been established to identify a subset of the most common congeners present in environmental media. The total PCB concentrations in sediment samples collected at the Hunters Point Naval Shipyard Site were estimated as two times the sum of 18 PCB congeners. As part of the evaluation of PCB concentrations at Yosemite Slough, sediment samples were analyzed for PCBs, quantifying the PCB concentrations using both the Aroclor method and as the sum of 28 PCB congeners. An evaluation of the measured concentrations between the two methods resulted in a correlation of the concentrations where the total PCBs measured using the Aroclor method was equivalent to 2.3 times the total PCBs measured using the 28 congener method. The total PCB concentrations used for evaluating the Site were estimated by multiplying the total PCBs (measured using the 28 congener method) times 2.3. Note that there are some uncertainties associated with this calculation, likely resulting in up to a 10% difference in total PCB concentrations.

3.3.3 COC Selection

The COPCs were further evaluated to determine the COCs that warrant consideration for remedial action by comparing the Sitewide 95% UCLs to various screening values. Generally, a risk assessment process is used to narrow the list of COPCs to COCs. However, for this Site, a screening level evaluation was primarily utilized. Although for some constituents, more relevant and Site-specific screening values were available, the majority of the screening values are generic and conservative aquatic life screening values consisting of the following, in order of preference:

- HPNS Parcel F remedial goals as listed in the Navy's Final Feasibility Study for Parcel F; HPNS dated April 30, 2008 (Navy 2008);
- National Oceanic and Atmospheric Administration (NOAA) effects range medians (ERMs; NOAA 1999);
- NOAA Screening Quick Reference Tables, or SQuiRTs[4]

Based on this screening evaluation, the initial list of COCs includes:

- Lead;
- PCBs; and
- Pesticides (i.e., chlordanes, dieldrin, and heptachlor).

A final COC selection step was conducted that incorporates a qualitative evaluation, or "preponderance of evidence" approach where other factors were

[4] For more information regarding SQuiRTs, see the following Web site: http://response.restoration.noaa.gov/cpr/sediment/squirt/squirt.html.

considered, including comparing older (i.e., collected in 2000 or earlier) to more recently collected data. The three pesticides listed above were only found in older datasets (collected from 1998 to 2000) and more recent data (from 2009 and 2012) did not result in any detection of these pesticides. Although some of the 2009 data showed elevated detection limits, many of the samples had adequate detection limits and the 2012 data, which targeted areas that indicated some of the highest concentrations, had low detection limits. Analytical data for bay-wide sediment collected by SFEI indicate the organochlorine pesticide concentrations have decreased by an order of magnitude or more over the last decade (http://www.sfei.org/rmp/wqt). The organochlorine pesticide concentrations in the Yosemite Slough have also decreased significantly between samples collected from 1998 to 2000 to samples collected in 2009 and 2012. Based on a review of the more recent sampling conducted in areas that previously had the highest concentrations, the concentrations of organochlorine pesticides have naturally attenuated to below applicable concentrations and are therefore no longer considered COCs.

Based on this assessment, lead and PCBs are the only COCs carried through to the alternatives analysis.

3.3.4 Nature of Contamination

As explained above, the primary COCs to be addressed by the non–time-critical removal action at the Site are PCBs and lead. Sediment has been identified as the principal media of concern; therefore, the removal action will address COCs in sediment. Table 3-3 summarizes the screening levels used to identify sediment distribution and volumes.

Table 3-3 Screening Levels for Sediments at Yosemite Slough

COC	NTE Concentration	Reference
PCBs	1,240 µg/kg	The NTE concentration for PCBs is based on the Navy HPNS Parcel F Risk Assessments (see Section 6 for more information)
Lead	436 mg/kg	The NTE concentration for lead is based on two times the AWA screening level for lead (218 mg/kg), which is based on NOAA ERM (see Section 6 for more information)

Key:
AWA = area-weighted average
COC = contaminant of concern
ERM = effects range median
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
NOAA = National Oceanic and Atmospheric Administration
NTE = not to exceed
PCB = polychlorinated biphenyl

For purposes of this EE/CA, the sediment screening levels for PCBs and lead are based on the Site remediation goals (RGs). The selection and values of RGs are presented in Section 6.

Figures 3-3 and 3-4 show the distribution of COCs compared to their respective screening levels in the 0- to 1-foot depth interval and the 1- to 2-foot depth interval, respectively. As explained in more detail below in Sections 3.4.2 and 4.2.2, the RGs apply to sediments within the biologically active zone (BAZ)[5], which is assumed to be 6 inches. Receptors are unlikely to be exposed to sediments below the BAZ, but EPA has conservatively compared the RGs to data in the top 2 feet, as discussed in Section 4.2.2. Therefore, although sediment samples deeper than this interval were analyzed for COCs (see Figures 3-5 through 3-7), those depths were not included in further evaluations, except for the Full Removal Alternative, described in Section 7.

3.4 Location of Contaminated Material

3.4.1 Navy HPNS Parcel F Thiessen Polygon Approach

The Navy documented PCB detections above their identified RGs throughout the South Basin area of Parcel F (Barajas & Associates, Inc. 2008). For Parcel F, the RGs were defined as a “do-not-exceed” value of 1,240 micrograms per kilogram (µg/kg) total PCBs. Removal of sediments within the top 2 feet that exceeded this value resulted in theoretical post-remedial area-weighted averages for PCBs and the other COCs that resulted in acceptable risk to ecological and human health receptors (see Section 4.2.2). A conservative approach was taken by using the highest chemical concentration detected at any depth within the interval evaluated (0 to 2 feet) to calculate the surface-weighted average concentrations (Barajas & Associates, Inc. 2008).

Polygons were constructed around individual sampling locations, so that the sides of each polygon are equidistant from adjacent sampling locations. Concentrations of COCs detected in sediment from a sampling location were assumed to represent all sediment within the polygon (Barajas & Associates, Inc. 2008).

3.4.2 EPA Yosemite Slough Thiessen Polygon Approach

For technical consistency with the Navy’s work in Parcel F, the EPA has adopted a similar approach at Yosemite Slough to determine removal areas. The Thiessen polygon method (Thiessen and Alter 1911) was used to define polygons using sampling locations and analytical results from the 2009 EPA study (see Section 2.13). Thiessen polygons were segmented into 1-foot depth intervals for the 0 to 1-foot interval and the 1 to 2-foot interval, consistent with the sampled depth intervals associated with the 2009 samples. The EPA considers exposures to contaminants in the BAZ to potentially pose risk to human and ecological receptors. As explained in Section 4.2.2, although, the BAZ is generally

[5] The BAZ is defined as the depth of significant biological processes or activity and is the area within the sediment in which a majority of the benthic macroinvertebrates is generally found.

considered to be the top 6 inches of sediments at the Site, the EPA is conservatively applying the lead and PCB screening levels to sediment analytical data for the top 2 feet of sediments for the specific purpose of alternative evaluation. Of all the COCs at Yosemite Slough, PCBs appear to be distributed the most extensively, with exceedances of screening levels occurring throughout the top 2 feet of Site sediments (see Figures 3-3 and 3-4). The distribution of lead concentrations exceeding screening levels is similar to the distribution of PCBs. In fact, only two locations (YC-017 and YC-024) show concentrations of lead above the screening level, while PCB concentrations are less than the screening level. Therefore, removal actions designed to address PCBs also will address lead. Because other chemicals are also co-located with PCBs and lead, the planned removal actions will also be effective in reducing concentrations of other chemicals detected in Yosemite Slough sediments at slightly elevated levels but not specifically identified as COCs. "Baseline" (i.e., pre-remedial) area-weighted average concentrations for lead and PCBs were calculated for the top 1 foot of sediments using the Thiessen polygons constructed from the 2009 sampling locations (see Table 3-4).

Table 3-4 Area-Weighted Average COC Concentrations in the Top 1-foot Interval at Yosemite Slough

COC	Area-Weighted Average Concentration
Lead	359 mg/kg
PCBs	5,049 µg/kg

Key:
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram

3.5 Volume of Contaminated Material

The Yosemite Slough boundary encompasses approximately 414,000 square feet. Table 3-5 presents an estimate of the volume of sediment exceeding RGs in each 1-foot depth interval at the Site.

Table 3-5 Estimated Volumes of Sediments Containing COCs above Screening Criteria at Yosemite Slough

Depth Interval (feet)	Contaminated Volume (CY)
0 to 1	5,500
1 to 2	12,100
2 to 3	8,300[a]
3 to 4	4,300[a]
4 to 5	0[a]

Note: a. As explained in Section 4, PCB and lead contamination deeper than 2 feet does not likely pose a significant risk to Site receptors.

Key:
CY = cubic yards

EE-002693-7008-02TTO/Fig 3-1 COC Flowchart.ai-01/02/2013-GRA

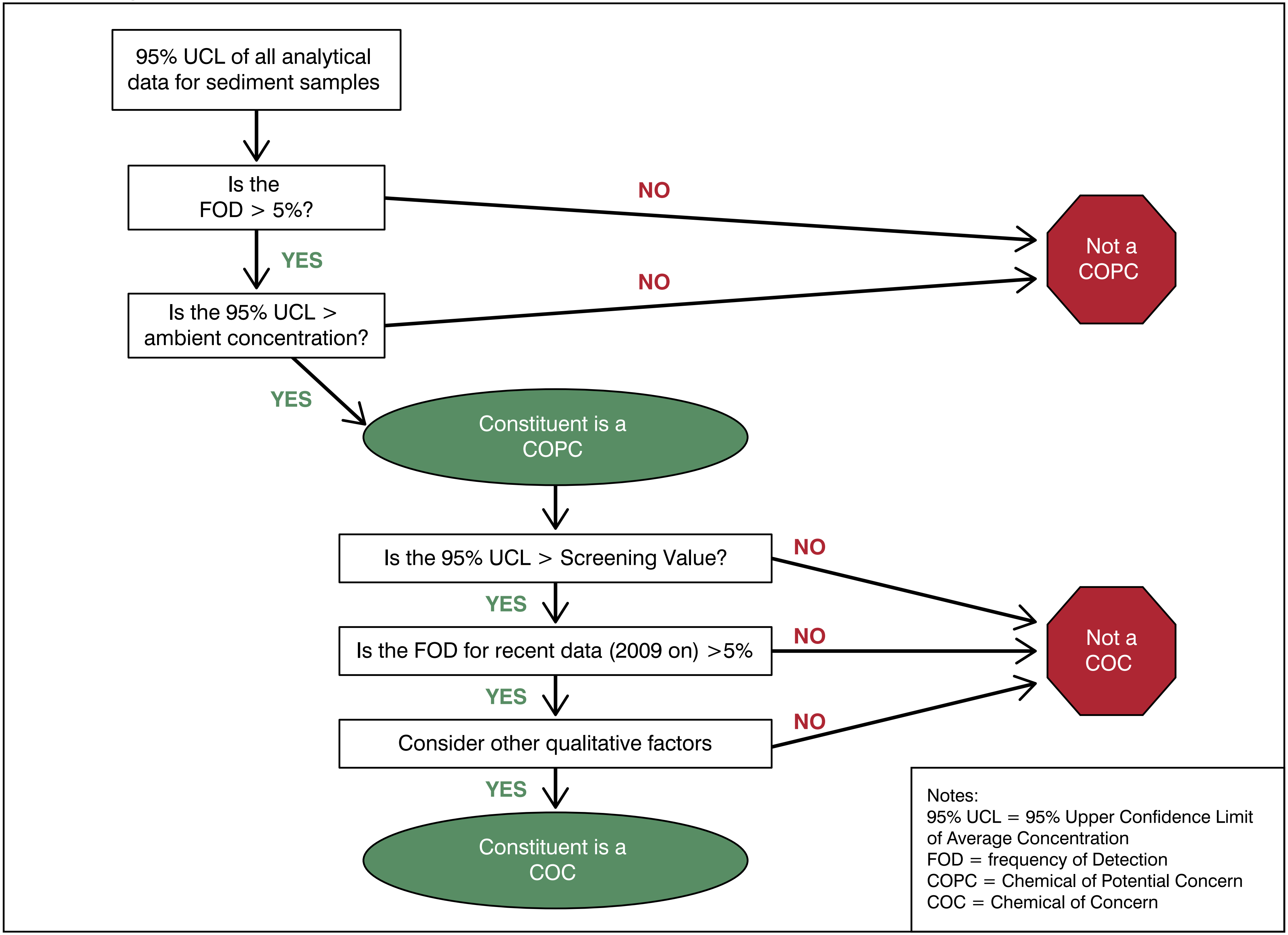
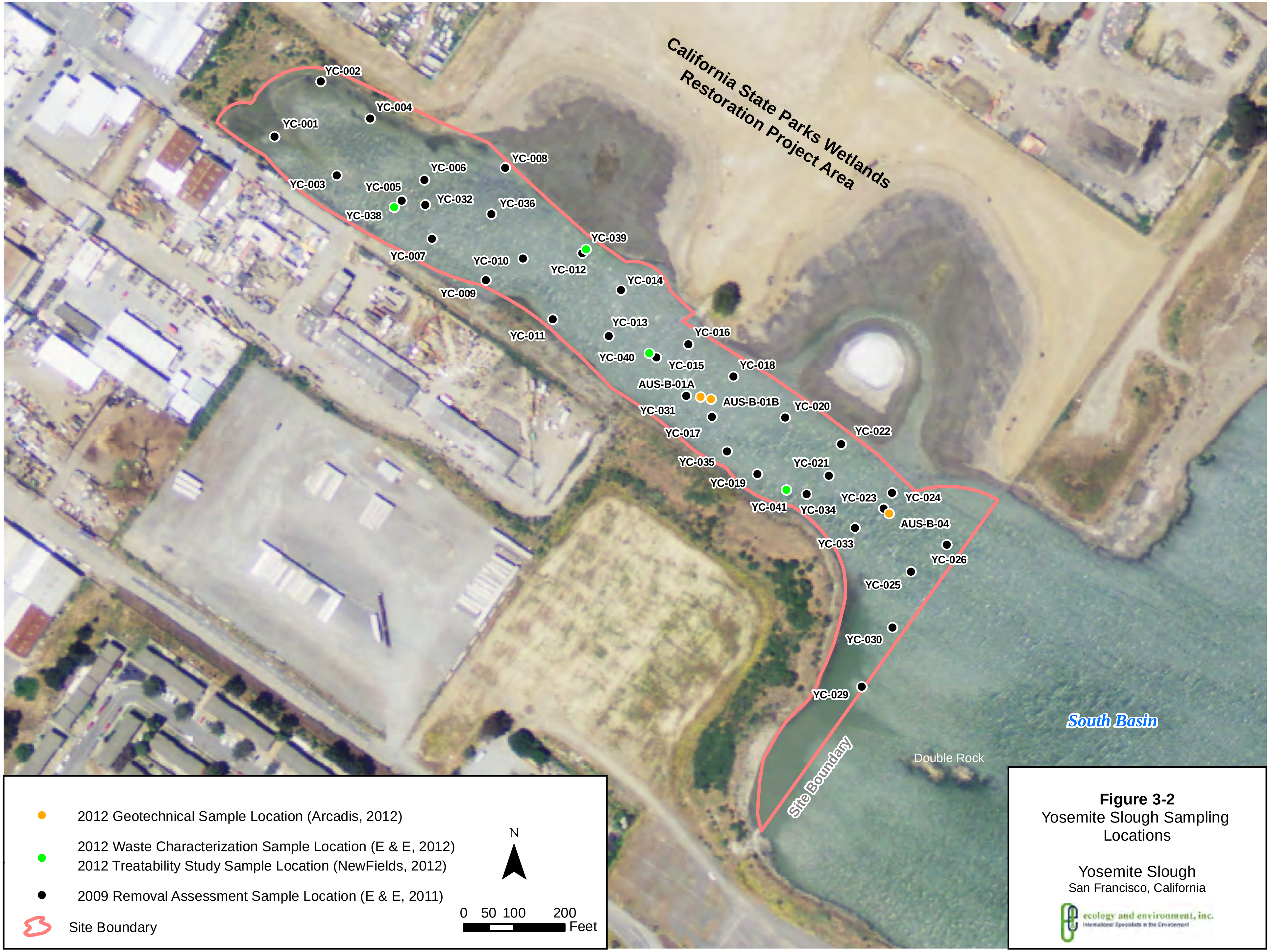


Figure 3-1 COC Flowchart

Path: M:\Oakland\Yosemite_Creek\Maps\MXD\Report\2012_December\Sample_Locations.mxd Figure 3-2 Sample Locations

Source: ESRI 2010; NAIP 2012.



2012 Geotechnical Sample Location (Arcadis, 2012)

2012 Waste Characterization Sample Location (E & E, 2012)
2012 Treatability Study Sample Location (NewFields, 2012)

2009 Removal Assessment Sample Location (E & E, 2011)

Site Boundary

N

0 50 100 200 Feet

Figure 3-2
Yosemite Slough Sampling Locations

Yosemite Slough
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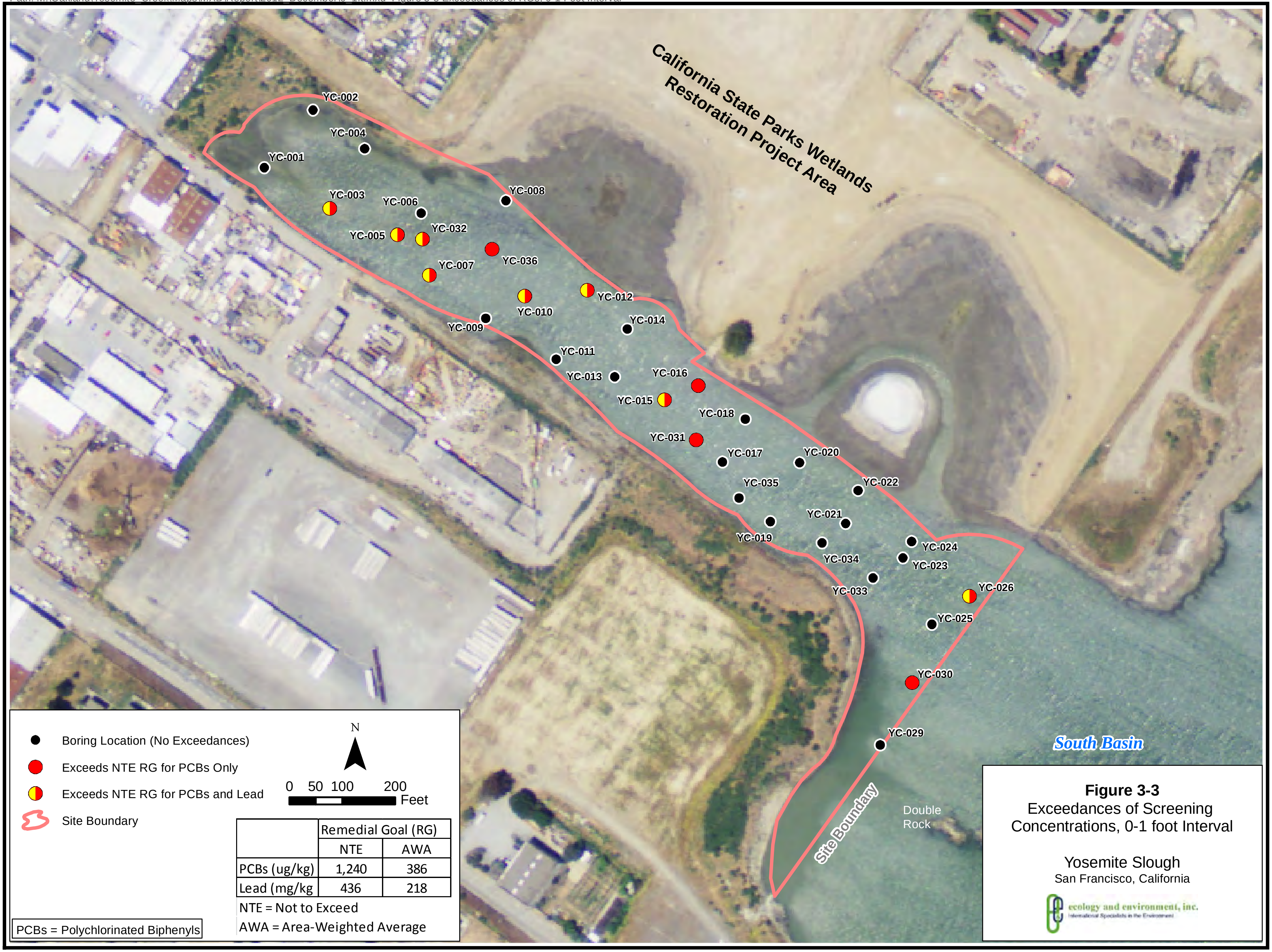
Path: M:\Oakland\Yosemite_Creek\Maps\MXD\Report\2012_December\0_1ft.mxd Figure 3-3 Exceedances of RGs, 0-1 Foot Interval

Source: NAIP 2012.



	Remedial Goal (RG)	
	NTE	AWA
PCBs (ug/kg)	1,240	386
Lead (mg/kg	436	218

NTE = Not to Exceed
AWA = Area-Weighted Average

Figure 3-3
Exceedances of Screening Concentrations, 0-1 foot Interval

Yosemite Slough
San Francisco, California

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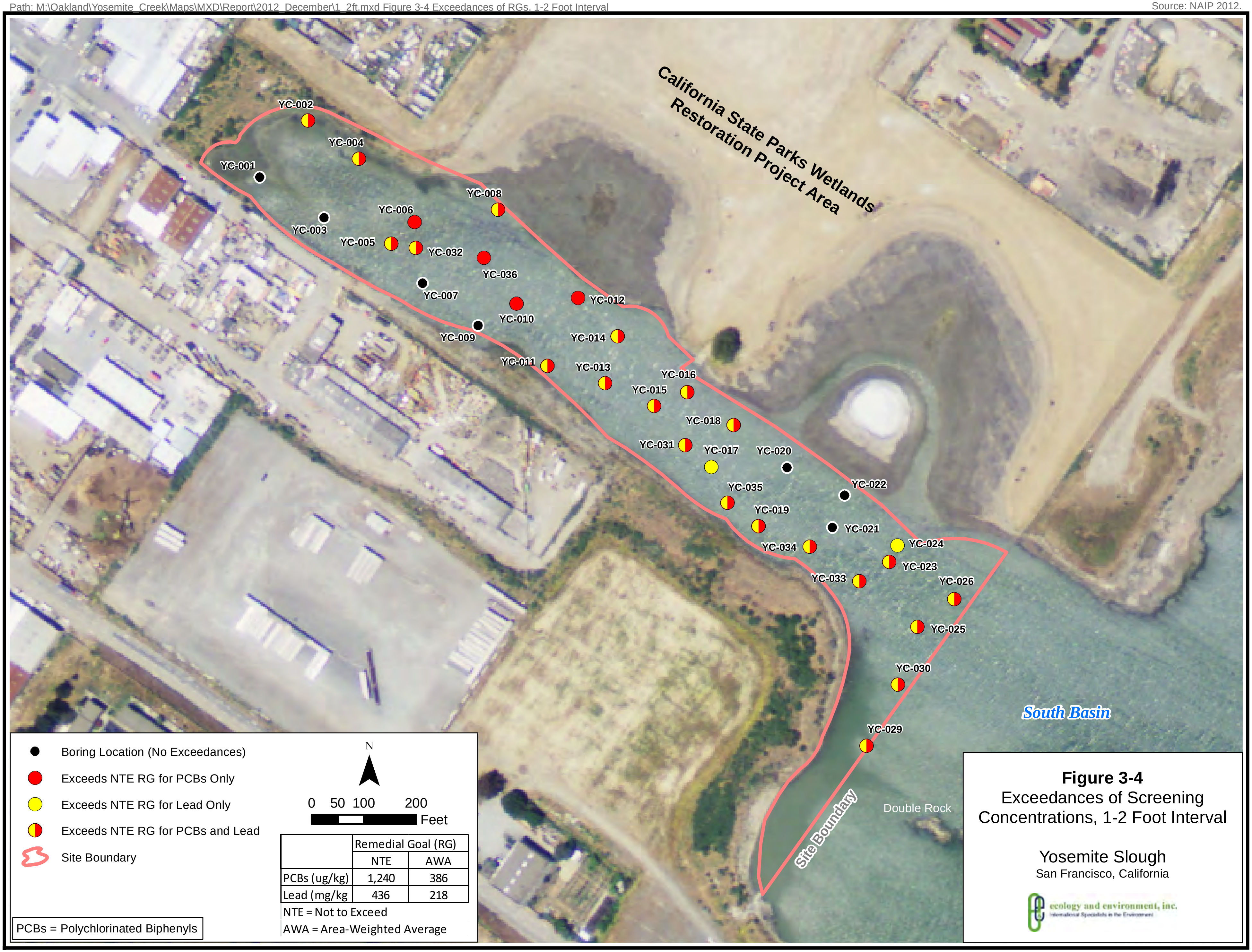


	Remedial Goal (RG)	
	NTE	AWA
PCBs (ug/kg)	1,240	386
Lead (mg/kg	436	218

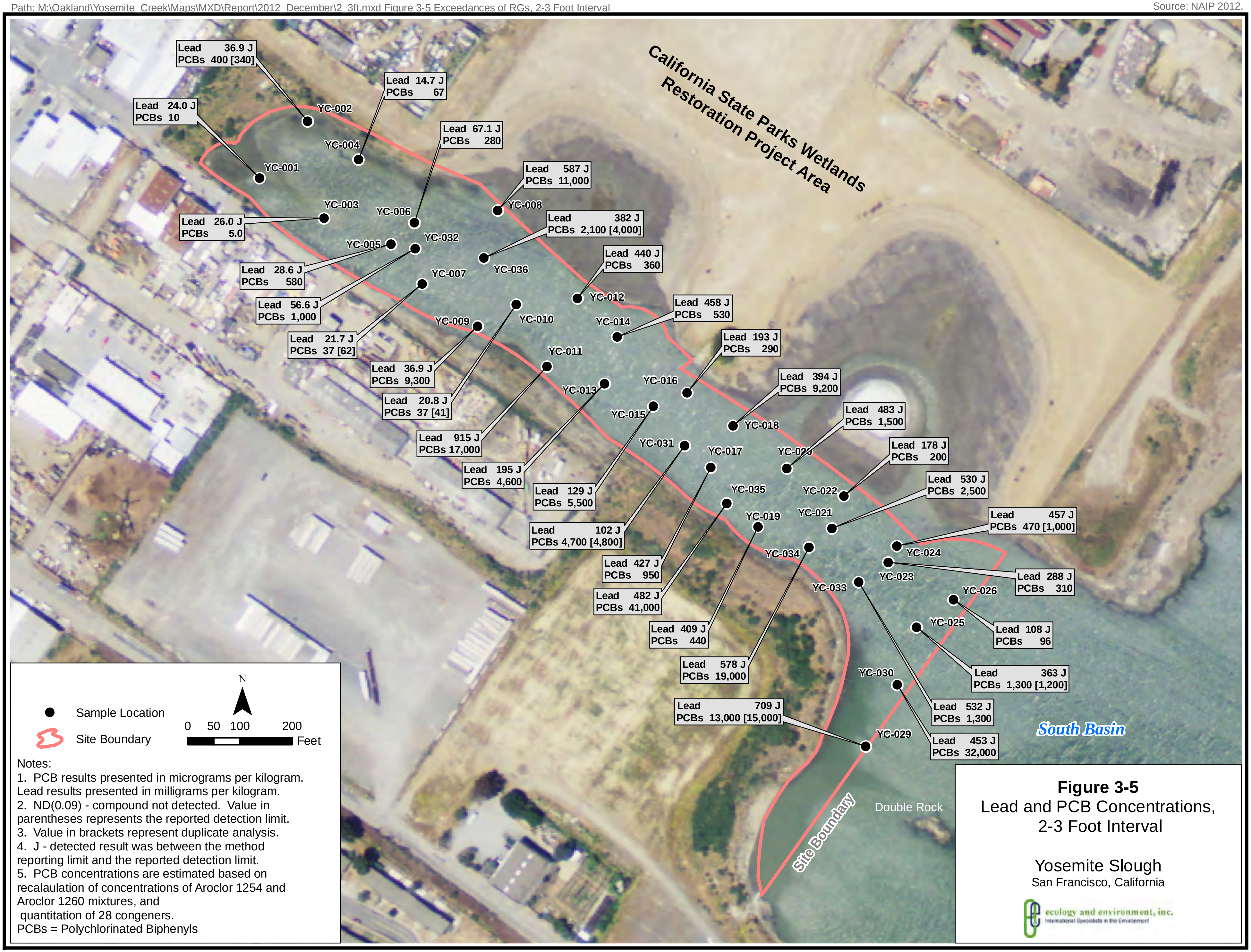
NTE = Not to Exceed
AWA = Area-Weighted Average

Figure 3-4
Exceedances of Screening Concentrations, 1-2 Foot Interval

Yosemite Slough
San Francisco, California

Path: M:\Oakland\Yosemite_Creek\Maps\MXD\Report\2012_December\2_3ft.mxd Figure 3-5 Exceedances of RGs, 2-3 Foot Interval

Source: NAIP 2012.



Notes:
1. PCB results presented in micrograms per kilogram. Lead results presented in milligrams per kilogram.
2. ND(0.09) - compound not detected. Value in parentheses represents the reported detection limit.
3. Value in brackets represent duplicate analysis.
4. J - detected result was between the method reporting limit and the reported detection limit.
5. PCB concentrations are estimated based on recalaulation of concentrations of Aroclor 1254 and Aroclor 1260 mixtures, and quantitation of 28 congeners.
PCBs = Polychlorinated Biphenyls

Figure 3-5
Lead and PCB Concentrations, 2-3 Foot Interval

Yosemite Slough
San Francisco, California

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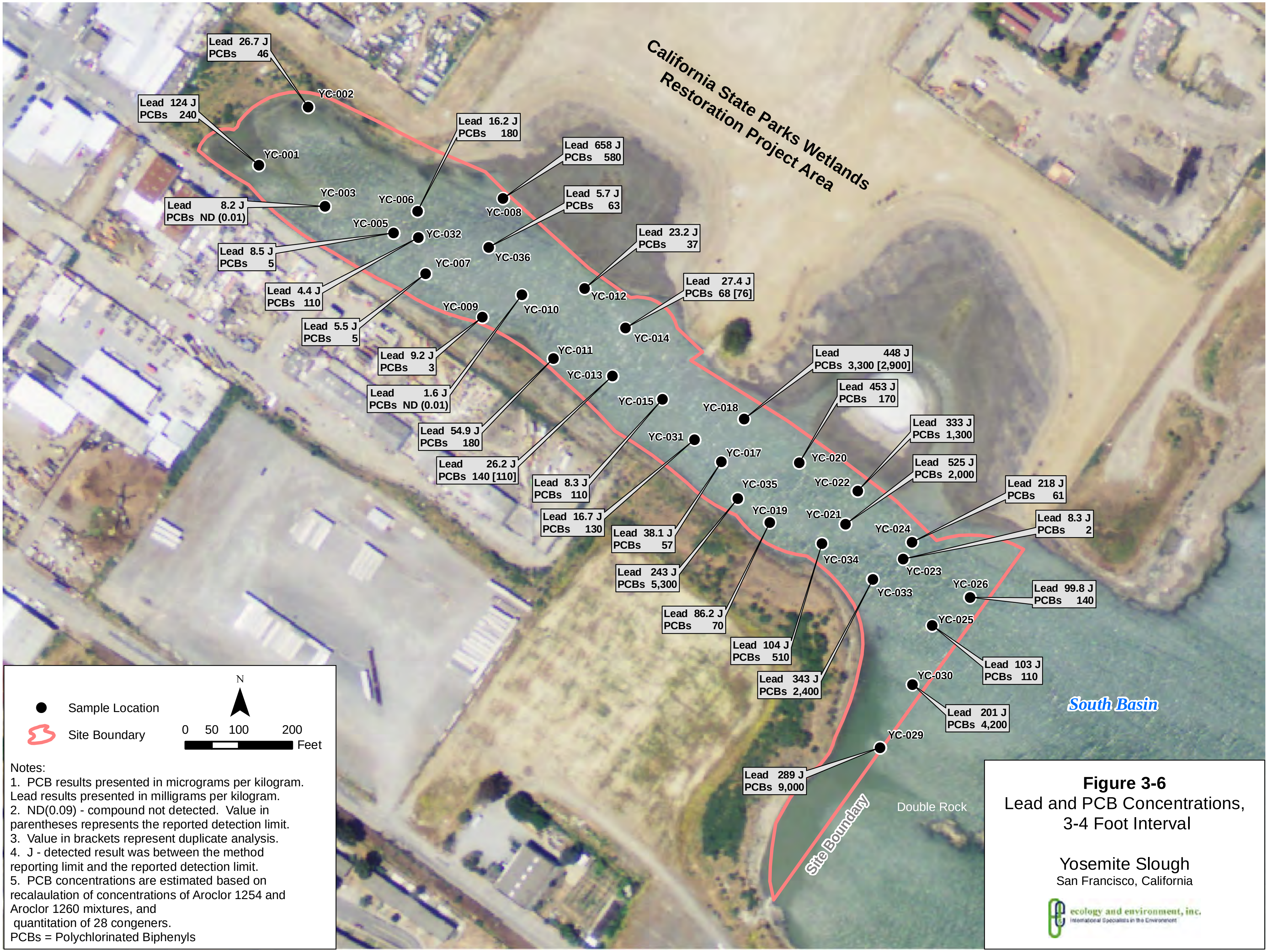
Path: M:\Oakland\Yosemite_Creek\Maps\MXD\Report\2012_December\3_4ft.mxd Figure 3-6_Exceedances of RGs, 3-4 Foot Interval

Source: NAIP 2012.



Notes:
1. PCB results presented in micrograms per kilogram. Lead results presented in milligrams per kilogram.
2. ND(0.09) - compound not detected. Value in parentheses represents the reported detection limit.
3. Value in brackets represent duplicate analysis.
4. J - detected result was between the method reporting limit and the reported detection limit.
5. PCB concentrations are estimated based on recalaulation of concentrations of Aroclor 1254 and Aroclor 1260 mixtures, and quantitation of 28 congeners.
PCBs = Polychlorinated Biphenyls

Figure 3-6
Lead and PCB Concentrations, 3-4 Foot Interval

Yosemite Slough
San Francisco, California

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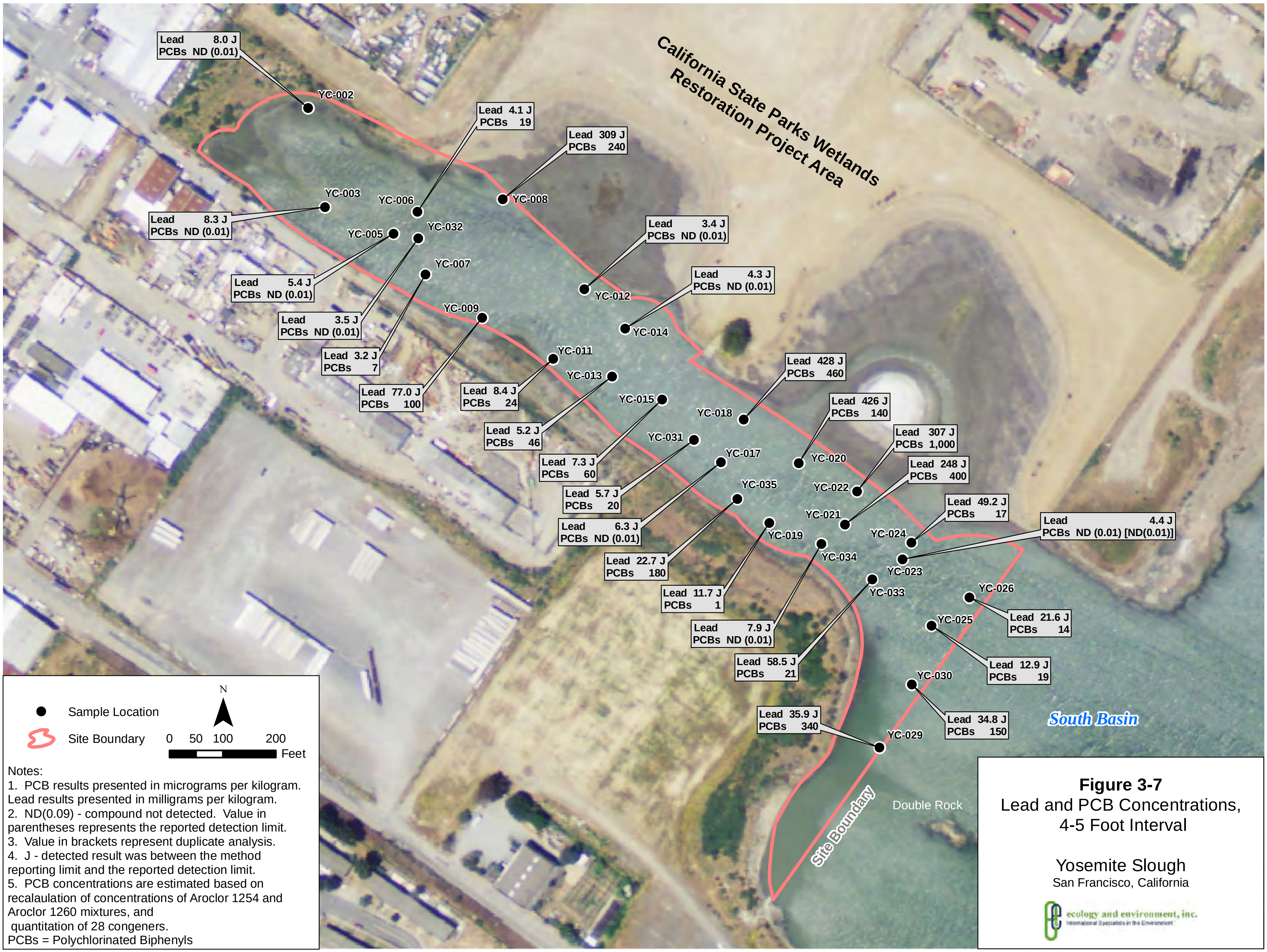
Path: M:\Oakland\Yosemite_Creek\Maps\MXD\Report\2012_December\4_5ft.mxd Figure 3-7 Exceedances of RGs, 4-5 Foot Interval

Source: NAIP 2012.



Notes:
1. PCB results presented in micrograms per kilogram. Lead results presented in milligrams per kilogram.
2. ND(0.09) - compound not detected. Value in parentheses represents the reported detection limit.
3. Value in brackets represent duplicate analysis.
4. J - detected result was between the method reporting limit and the reported detection limit.
5. PCB concentrations are estimated based on recalaulation of concentrations of Aroclor 1254 and Aroclor 1260 mixtures, and quantitation of 28 congeners.
PCBs = Polychlorinated Biphenyls

Figure 3-7
Lead and PCB Concentrations, 4-5 Foot Interval

Yosemite Slough
San Francisco, California

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4 Streamlined Risk Evaluation

4.1 Site Conceptual Exposure Model

This section summarizes the Site conceptual exposure model (SCEM) for Site-related contaminants. The SCEM describes the sources and nature and extent of contamination, and provides information about fate and transport and potential exposure pathways and receptors for the contaminants. Assessment of risk to human and ecological receptors at the Site is also presented in this section.

The SCEM is based on review and interpretation of physical and chemical data gathered during previous investigations at the Site and the information on land uses, human use and habitats/species that may be present are described in this section. Those data found to be usable were compiled into a master database and used for this EE/CA. Figure 3-2 presents sediment sample locations for which analytical data were available and appropriate for use in the EE/CA. These data are summarized in tables provided in Appendix C.

The SCEM for the Site is depicted in Figures 4-1 and 4-2, and is summarized below.

4.2 Contaminant Migration Pathways and Receptors

In general, the main elements of how contaminants move in our environment and come in contact with humans or ecological receptors are:

- A potential or suspected source and mechanism of chemical release into the environment;
- A retention or transport medium that allows the contaminant to move;
- A point of potential human or ecological contact (i.e., current and future receptors); and
- A point of entry or exposure route at the contact point.

Consistent with EPA (1989) guidance, each of these elements must be present for an exposure pathway to be complete. In the absence of a complete exposure pathway, there would be no exposure to identified COCs, and as a result no related impacts.

At the Yosemite Slough Site, sediment has been identified as the principal media of concern. The sources, release mechanisms, and transport pathways regarding how Yosemite Slough sediments became contaminated have been described in Section 3.1. The following discussion identifies the exposure pathways and the receptors that may be exposed to sediment-related within the boundaries of the Site. In this discussion, "sediment" is used to refer to both the solid and liquid (pore water) components of bulk sediment.

4.2.1 Current and Future Beneficial Use of Yosemite Slough

Current and anticipated beneficial uses of Yosemite Slough (and shoreline areas) include:

- **Fishing and Shellfishing.** Currently, shell fishing and fishing are believed to be limited due to lack of abundant shellfish and fish resources at the Site and restricted public access to the Site. However, upon completion of the adjacent wetlands restoration project and selected cleanup actions for the Site, shell fishing and fishing are anticipated to return as allowed by the CPSRA although fishing will be generally from the shore as boats can only access the Yosemite Slough at high tide and shell fishing will still be limited by the lack of significant beds in the area;

- **Wetlands Habitat and Ecological Restoration.** Ecological habitat use includes inter-tidal mudflat habitat with marine wetlands along the shoreline. Flora and fauna that could use the Site and adjacent areas are described in Section 4.2.2;

- **Open Space Recreation.** A limited amount of low water contact recreation, such as use of non-powered, small watercraft in Yosemite Slough during high tides is allowed but not anticipated to a great degree. Inland and immediately adjacent to the Site, open space recreation, such as hiking, jogging, bird watching and biking does not occur to a great degree now, but is anticipated to increase in the future upon completion of wetlands restoration and construction of a planned walking trail around the Yosemite Slough (see Figure 2-7).

Based on CPSRA wetland restoration plans and associated open space recreational opportunities to be developed in the future, public access to the Yosemite Slough banks and water in the slough will be restricted by dense wetland plantings and the lack of beach areas along the Site. Due to the planned walking trail planned around the Site, it is possible that unauthorized trails will develop to the Site's banks and people with dogs may visit the slough banks in the future, although that will be discouraged. Other types of recreation involving higher water contact recreation, such as swimming and windsurfing, are not likely to occur at the Site due to shallow water levels (average 0 to 3 feet); such recreation will be located at other portions of the CPSRA south of the Site.

4.2.2 Relevant Exposure Pathways and Receptors

The contaminants at the Site can persist in sediments over long periods of time. Metals, such as lead, do not degrade and PCBs degrade very slowly (NRC 2007). Human users of the Site may be exposed to COCs in environmental media in a variety of ways, including direct/dermal contact, and incidental ingestion. At most contaminated sediment sites, humans are typically exposed to contaminants through direct contact to contaminated sediment during, for example, recreational activities, and through ingestion of shellfish or fish that have accumulated contaminants from the sediment (NRC 2007). Given the tendency of the contaminants to sorb to solids, contaminant distributions in Site media (limited mainly to solids in the slough channel and slough banks soils), and limited recreational use of the Site, these exposure routes appear to be the primary routes for human exposure at the Site.

Ecological receptors at the Site may be exposed through a number of pathways, including direct contact/absorption from pore water or sediments, incidental ingestion of contaminated sediments, and consumption of contaminated prey.

Sediment-associated contaminants tend to collect in relatively stable depositional zones in water bodies, although high flow events and changes in hydrologic conditions may lead to short-term erosion and transport of these contaminants to the BAZ (NRC 2007). It is also important to note that at sediment cleanup sites, such as Yosemite Slough, contaminants are sometimes resuspended and released during natural processes (e.g., major storm events and bioturbation) and during cleanup operations. Release occurs when contaminants are transferred from sediment pore water and sediment particles into the water column or air (NRC 2007). Releases to the water and air are directly related to the degree of sediment resuspension and the method of sediment processing (NRC 2007). Resuspension is the dislodgement of embedded sediment particles, which disperse into the water column and then resettle in the immediate area or are transported via tidal currents and for subsequent resettling (NRC 2007). The interaction of Site contaminants with soil, water, and air media are presented in Figure 4-2.

Ecological risk from Site sediments is primarily related to the presence of and exposure of receptors to contaminants within, or that can migrate into, the BAZ. The BAZ consists of the upper layers of sediment where organisms live or interact, forage, and feed. The BAZ layer typically ranges from a few centimeters to 10 to 15 centimeters (3.9 inches to 5.9 inches) deep, although some organisms may penetrate more deeply (NRC 2007). Benthic activity is typically most intense within the uppermost 10 centimeters of the sediment column and decreases exponentially with depth (USACE 2001; Palermo et al. 1999).

At Yosemite Slough, Site sediments are many feet thick; however, only the surface sediments are considered biologically active. The nature and thickness of the BAZ in HPNS Parcel F was assessed by the Navy (Barajas & Associates, Inc. 2008). Results of the Navy's literature review indicate that the depth of the BAZ in marine sediments averages about 10 centimeters (3.9 inches) and rarely exceeds 30 centimeters (11.8 inches). The Navy's testing of biota in Parcel F found that, based on 20 stations in South Basin, the approximate depth of bioturbation (the mixing of sediments by worms and similar animals that live in sediment and pore water) exchange caused by bioturbation was approximately 2 to 10 centimeters deep (0.8 to 3.9 inches). Feeding voids were observed to depths of 15 centimeters (5.9 inches) which possibly indicated particle mixing depth by head-down feeders (polychaetes). However, the studies did not characterize fauna below approximately 8 centimeters (cm). Polychaetes, or head-down feeders, and burrows were observed to depths of 20 to 30 centimeters (7.9 inches to 11.8 inches), although at lower densities than in the surficial layer (Germano & Associates, Inc. 2004).

The HPNS Parcel F Validation Study (Battelle et al. 2005) noted that a 15-centimeter (5.9-inch) BAZ was appropriate for San Francisco Bay. The EPA's Contaminated Sediment Remediation Guidance for Hazardous Waste Sites (EPA 2005) suggests that the BAZ typically ranges between 15 centimeters (5.9 inches) and 20 centimeters (7.9 inches) below the sediment surface. This is also consistent with the findings in the RWQCB's Total Maximum Daily Load document for PCBs (RWQCB 2008).

At Yosemite Slough, the BAZ is assumed to be 6 inches (approximately 15 centimeters). For purposes of evaluating risk posed by contaminants at Yosemite Slough, the EPA has elected to assume an 18-inch margin of safety below the BAZ for purposes of identifying Site contamination that may pose unacceptable risk and alternative development. This additional 18-inch margin of safety may be needed to protect burrowing marine animals (e.g., bat rays) that have been known to burrow in mudflats up to 1.5 feet deep. During the design stage, for the selected response action, the EPA may re-evaluate this assumption based on information collected during additional pre-design studies. A number of factors will be considered in design, including the depth of bioturbation, erosion, and scouring within the Slough, and other types of disturbance that could impact the long-term performance of the selected remedy. A range of clean-up action alternatives are discussed in Sections 7 through 9 to protect receptors from unacceptable risk posed by contamination in the top 2 feet of sediments. However, based on information collected during the design phase for the selected response action, the EPA may determine that a greater or lesser sediment thickness of sediment contamination may pose unacceptable risk and the scope of the selected response action may be modified as appropriate at that time.

As presented in the SCEM, for human and ecological receptors, exposure to sediment contaminants may be direct or indirect. Direct exposure results from contact with contaminated sediment. Indirect exposure results from contact with contaminants that have been transferred from sediments to another exposure medium, such as water or biota.

Relevant direct exposure pathways include:

- Direct contact with contaminated sediment. Exposure to contaminants occurs when external surfaces (skin) comes in direct contact with the contaminated sediment; and

- Incidental ingestion of contaminated sediment. Exposure to contaminants occurs incidentally during feeding or grooming, and/or when drinking or swallowing bay water with suspended contaminant sediments.

Relevant indirect exposure pathways include ingestion of food/prey items that have become contaminated through direct exposure to sediment contaminants.

For humans and avian/mammalian wildlife, exposure to contaminants via dermal contact with sediments is typically considered minor compared to the ingestion pathway. However, both external contact and ingestion of contaminated sediment can be important for fish and aquatic invertebrates. Bioconcentration and biomagnification are processes that affect exposure, especially in aquatic-based food webs. Bioconcentration is the increase in concentration of a chemical in an organism resulting from tissue absorption levels exceeding the rate of metabolism and excretion. Metals and organic compounds may bioconcentrate. Biomagnification occurs when concentrations of a chemical in biota increase with successive trophic levels. Biomagnification is best known with regard to persistent organic chemicals, such as PCBs, but can also occur for organically transformed metals. The Navy's risk assessment studies for HPNS Parcel F considered both bioconcentration and biomagnifications when developing RGs protective of both human and ecological receptors.

As noted previously, Yosemite Slough includes sediment contaminated with PCBs and lead within the designated Site boundaries. Exposures related to potentially contaminated soils immediately upland of the Site are being addressed under the Water Board Order for the State Parks Wetland Restoration Project. Likewise, exposure to contaminants via San Francisco Bay surface water within Yosemite Slough is addressed by the Water Board's Basin Plan and the SFPUC National Pollutant Discharge Elimination System (NPDES) permit for the South East Treatment Plant. The SFPUC NPDES specifies allowable effluent durations and quality from the three combined sewer outfalls at Yosemite Slough to protect beneficial uses of the Yosemite Slough as specified by the Basin Plan.

4.2.2.1 Human Receptors

CERCLA's implementing regulations state that RGs shall establish acceptable exposure levels that are protective of human health and the environment and shall be developed by considering the following:

- For systemic toxicants, acceptable exposure levels shall represent concentration levels to which the human population, including sensitive subgroups, may be exposed without adverse effect during a lifetime or part of a lifetime, incorporating an adequate margin of safety; and

- For known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between 10^{-4} and 10^{-6} using information on the relationship between dose and response. The 10^{-6} risk level shall be used as the point of departure for determining RGs for alternatives when ARARs are not available or are not sufficiently protective because of the presence of multiple contaminants at a site or multiple pathways of exposure [40 CFR 300.430(e)(2)(i)].

At Yosemite Slough, human receptors potentially exposed at the Site include (1) persons who fish and/or collect shellfish at the slough and/or consume the sea products that they obtain, and (2) persons engaged in activities during which they may contact sediments in Yosemite Slough. The Navy developed preliminary RGs for PCBs derived from site-specific human health and ecological risk assessment work completed for Parcel F of the HPNS. These preliminary RGs were based on the protection of human health based on human consumption of shellfish and direct contact with contaminated sediments as well as protection of benthic and avian ecological receptors. As reported in the Navy's Parcel F Feasibility Study, site-specific human health risk assessment and ecological risk evaluations provided in the Final HPS Parcel F *Validation Study* (Barajas & Associates, Inc. 2008) the following sediment RGs for PCBs for Parcel F:

- A not-to-exceed value of 1,240 µg/kg PCBs; and

The Navy concluded that the not-to-exceed value of 1,240 µg/kg PCBs was sufficient to protect human health. However, it is EPA's position that it is necessary to supplement the protectiveness of the PCB RG with a 0.386 mg/kg area-weighted average (AWA) that was calculated by the Navy in response to regulatory agency comments on Parcel F feasibility study documentation. The 0.386 mg/kg AWA standard is based on a theoretical post-remedial AWA following removal of all sediments with over 1,240 µg/kg of PCBs within Parcel F (in the top 2 feet of sediment). The Navy found that human health preliminary remedial goals for PCBs in sediment ranged from 135 µg/kg to 13,500 µg/kg for cancer risks of 1×10^{-6} to 1×10^{-4}, respectively. When applied together, these two remedial goals (i.e., the not-to-exceed value of 1,240 µg/kg PCBs and the 0.386 mg/kg AWA) for PCBs translate to a theoretical excess human health risk of approximately 3×10^{-6}.

The Navy's human health risk assessment did not develop separate numerical goals for protecting humans from the fish consumption pathway due to uncertainties associated with the fish consumption pathway, such as the difficulty in linking tissue concentrations in larger sport fish to Site-specific sediment concentrations in South Basin. CERCLA Section105 (a) (8)(A) states that the established risk-based criteria should consider, "taking into account to the extent possible the population at risk…". In addition, 40 CFR 300.430d(2)(vii) states that the Superfund site investigation should assess "factors, such as *sensitive* *populations*, that pertain to the characterization of the site or support the analysis of potential remedial action alternatives."

Based on the results of the Navy's human health risk evaluation for Parcel F, risk to humans from chemicals in Parcel F sediments appear to be similar to risk from ambient conditions throughout the Bay, with the exception of PCBs (Battelle and Neptune & Co. 2005). This risk assessment found that only total PCBs in jacksmelt (*Atherinopsis californiensis*) were associated with Parcel F contaminants and present at risks above the EPA allowable risk threshold under CERCLA. The Navy assumed a shellfish consumption rate of 2.13 grams per day in their human health risk assessment. Assuming the PCB pollution burden in fish is similar to shellfish and the fish consumption rate is equivalent to the shellfish consumption rate (i.e., consumption of sea products from San Francisco Bay of 4.26 grams per day), then sediment RGs for PCBs would result in a 6×10^{-6} excess cancer risk level. This risk level remains well within the EPA allowable risk range required by CERCLA. Therefore, the EPA finds that the Navy's RG for PCBs in sediment to be protective with an adequate margin of error for sensitive populations who consume both shellfish and fish from San Francisco Bay.

In summary, the RGs to address risks to human health due to exposure to contaminated Site sediments are based on the Navy's risk assessment studies at HPNS and the EPA's re-evaluation of those studies for application at Yosemite Slough. The EPA has concluded that application of the above-referenced RGs at Yosemite Slough is protective of human health.

4.2.2.2 Ecological Receptors

Ecological receptors potentially exposed to sediment contaminants at Yosemite Slough are listed in Section 2.9. The Navy's ecological risk assessment relied on data from three lines of evidence: bulk sediment chemistry, direct toxicity to invertebrates, and bioaccumulation of chemicals by invertebrates under laboratory conditions (Barajas & Associates, Inc. 2008). Uptake of chemicals from sediment to benthic invertebrates was evaluated to support risk estimates to birds, such as the surf scoter (*Melanitta perspicillata*), that primarily feed on mollusks (e.g., clams). The Navy found that surf scoters may be at risk from ingested doses of lead and PCBs if the birds obtain more than 50% of their daily food intake from the South Basin.

The following provides an overview of the types of ecological receptors that may exist at Yosemite Slough. Because of current limited habitat quality, especially in the upland adjacent to the Site, not all of the receptor types listed here are necessarily represented in the Site or immediate vicinity. However, the following is provided to identify the scope of species that may occur at the Site or in nearby South Basin:

- **Benthic Infauna and Epibenthic Organisms.** These receptors consist of organisms, such as insects that are in intimate contact with top layer of Site sediment. Many species of infauna are also filter feeders or otherwise process sediment during feeding;

- **Shallow Bay Fish.** Fish, such as Pacific herring, northern anchovy, lingcod, starry flounder, jacksmelt, and several surf perches may visit the Site and have direct contact with sediment, and may ingest sediment as they forage. The green sturgeon is discussed in the threatened and endangered species section.

- **Waterfowl.** Waterfowl that may visit the Site include double-crested cormorant, and several dabbling and diving ducks, such as the surf scoter. The waters near wetland habitat are commonly occupied by wintering ducks, including bufflehead, lesser Scaup, barrow's Goldeneye, and surf scoter. These birds may have contact with contaminated sediments as a result of feeding. Dabbling ducks may be directly exposed through incidental ingestion of sediment and indirectly exposed through ingestion of contaminated prey or vegetation during feeding.

- **Wading Birds.** Wading birds may directly ingest sediment as they probe beaches and shallow sediment for invertebrates. They may be indirectly exposed through ingestion of contaminated prey species.

- **Raptors.** Aquatic-feeding raptors, such as osprey, hawks, and eagles, may be indirectly exposed as they ingest contaminated fish from the water column. Direct exposure through ingestion of contaminated sediments by such species is limited to the sediment contained in the gastrointestinal tract of the prey species.

- **Marine Mammals.** Marine mammals, such as the California sea lion and harbor seal, have been observed in waters near the HPNS, but are less likely to use the Site due to the shallow water conditions.

The Navy concluded that the cleanup goals for PCBs in Parcel F sediment that were developed for the protection of ecological receptors were also protective of human health. Typically, ecological remedial goals based on foraging species, such as the surf scoter, are calculated and applied as an AWA since these types of receptors are exposed across their foraging areas and not on a point-by-point basis. At HPNS, the approach used for calculating risk for the surf scoter as a not-to-exceed level assumes exposure on a point-by-point basis and is thus more conservative than calculating risk based solely on an AWA. Therefore, the Navy concluded that their not-to-exceed remedial goal of 1,240 µg/kg PCBs (based on a site use factor of 0.5) would be protective of the surf scoter. Additionally, the Navy concluded that the AWA remedial goal of 386 µg/kg PCBs is overly protective as the remedial goal for the surf scoter based on a site use factor of 1 is 620 µg/kg.

Appendix A presents a supplemental ecological risk evaluation for the protection of threatened and endangered species at Yosemite Slough.

02:EE-002693-7008-02-B3681TTO\Figure 4-1 SCEM Schematic.ai-01/21/13-GRA

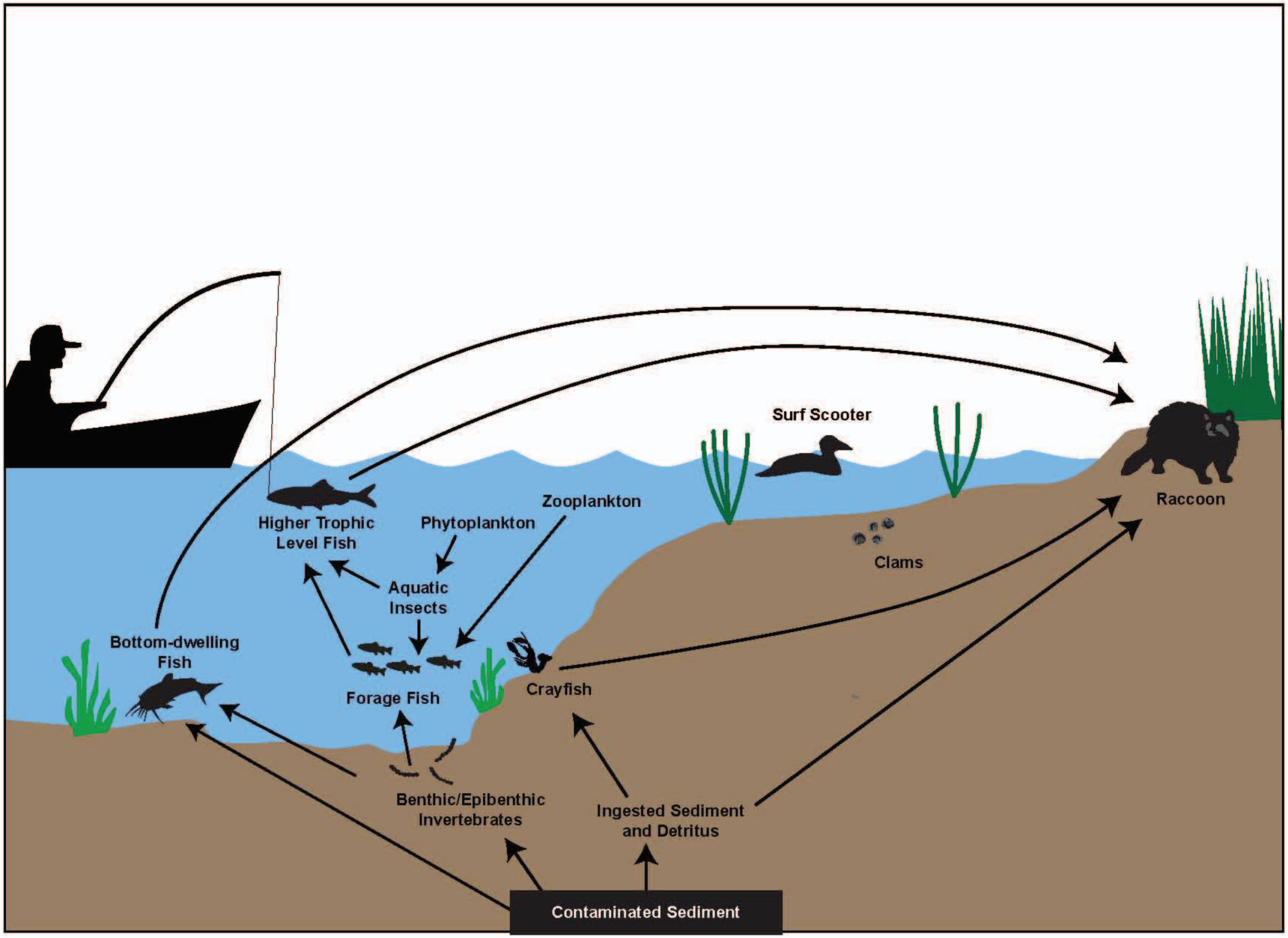

Figure 4-1 Site Conceptual Exposure Model

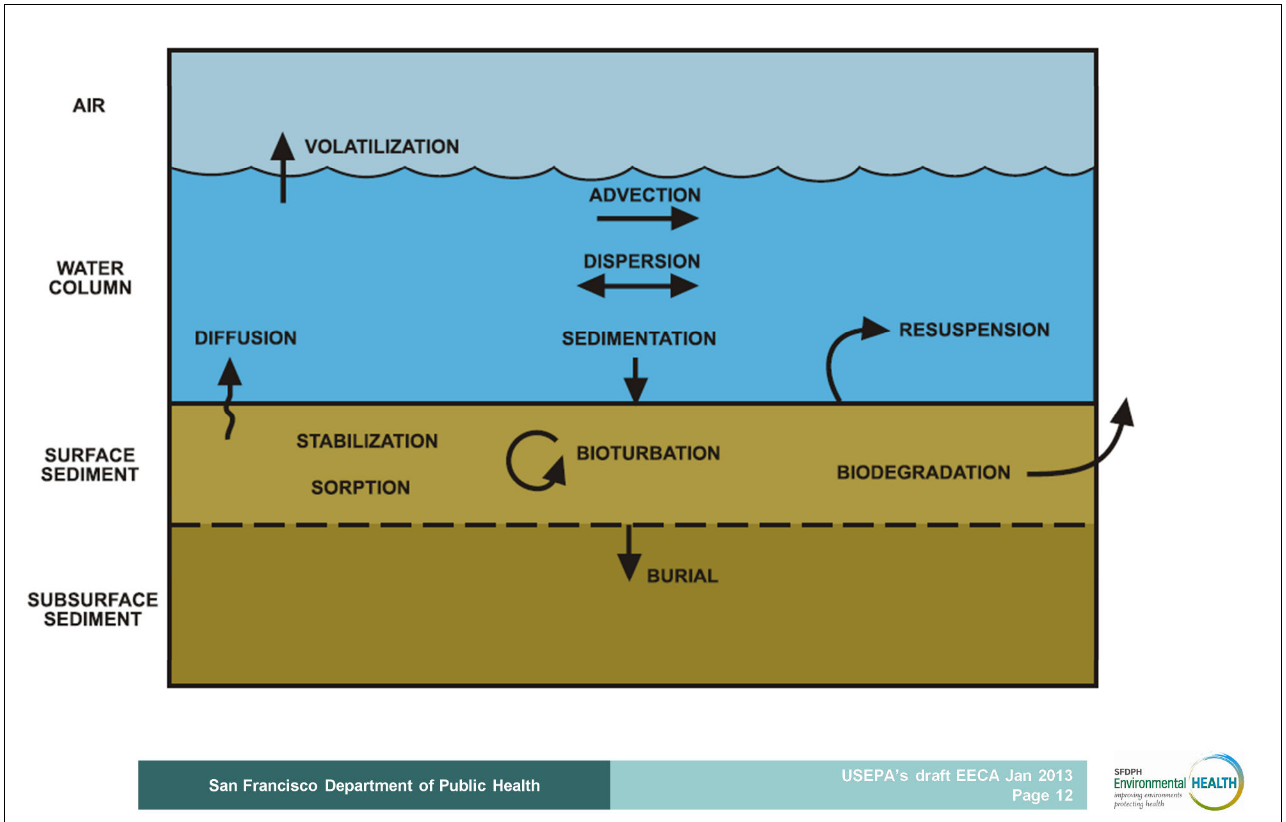

Figure 4-2. Interaction of COCs with Sediment, Water and Air Media

5 Applicable or Relevant and Appropriate Requirements

The EPA has identified potential applicable or relevant and appropriate requirements (ARARs) for this CERCLA removal cleanup action. The EPA's document *Guidance on Consideration of ARARs during Removal Actions* (EPA 1991) provides the definitions given below.

Applicable requirements are cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstances found at a CERCLA site.

Relevant and appropriate requirements are cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location or other circumstances found at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site and are well-suited to the particular site.

Other information to be considered generally falls within three categories: health effects information with a degree of credibility, technical information on how to perform or evaluate site investigations or response actions, and policy (EPA 1991).

For the Yosemite Slough Site, a detailed discussion of ARARs is presented in Appendix F. Appendix F identifies the major federal and state requirements that may be associated with a removal action at Yosemite Slough, including potential action-specific ARARs that may apply to the selected removal action alternative. For non-time critical removal actions (NTCRAs), final ARARs are selected in EPA's decision document, which is called an Action Memorandum.

6 Identification of Removal Action Objectives

Removal action objectives (RAOs) are the overall goals for a cleanup action. Generally, RAOs identify the COCs, exposure routes, and receptors. RAOs are intended to be a general description of the Site-specific objectives for reducing risk and achieving adequate protectiveness. Protectiveness can be achieved in two ways: by limiting or eliminating the exposure pathway, or by reducing or eliminating chemical concentrations. RAOs also provide the basis for RGs. RGs are the risk-based concentrations for the COCs in the media of interest. At the Site, the media of interest is sediment, so RGs have only been developed for sediment.

6.1 Removal Action Objectives

Based on input the EPA received from a variety of stakeholders for the Site, the following RAOs were developed for the Site:

1. **Protect Current and Future Beneficial Uses.** Remediate COCs in a manner that provides protection of human health and the environment based on reasonably anticipated current and future beneficial uses of the Yosemite Slough including those described in the Regional Water Quality Control Board's Basin Plan and the California State Parks General Plan for the CPSRA.

2. **Protect Human Health.** (a) Limit or reduce the potential risk to human health from the exposure to COCs through consumption of shellfish; (b) limit or reduce the potential for biomagnification of COCs to higher trophic levels in the food chain to reduce the risk to human health from consumption of sport fish; and (c) limit or reduce the potential risk associated with direct contact with sediment contaminated by COCs, including contact by workers, vendors, and the general public.

3. **Protect Wildlife.** Limit or reduce the potential risk to benthic feeding and piscivorous birds from exposure to COCs, including risk associated with consumption of contaminated prey and incidental ingestion of sediment.

4. **Support and Protect Healthy Aquatic and Benthic Communities.** (a) Limit or reduce the potential risk to aquatic and benthic communities; and (b) establish post-remedial slough bottom conditions that support slough habitat (i.e., tidal mudflat) and a healthy benthic ecology.

5. **Prevent Site Recontamination and Prevent Contaminant Migration to Adjacent Areas.** Provide a remedy that (a) prevents, to the extent practicable, the migration of resuspended sediment during or following any removal operations to adjacent areas (e.g., California Parks wetland restoration areas, other wetland restoration areas, and South Basin), and; (b) ensures that the Yosemite Slough is not re-contaminated following remediation (i.e., permanence of the remedy).

6. **Protect local properties, residents, workers, and natural resources during sediment remediation.** Provide a remedy that limits or reduces, to the extent practicable, potential impacts to the surrounding community and environment during cleanup action activities (e.g., traffic, safety, dust, air emissions, odor, noise, potential for spills, carbon footprint, and business disruption).

7. **Provide a Cost Effective Remedy.** Provide a remedy that provides the greatest value (i.e., cost-effectiveness) while still meeting the above RAOs.

6.2 Sediment Remedial Goals

Based on the quantitative human health and ecological risk assessment by the Navy in South Basin and other health-based criteria, the EPA has adopted the following cleanup goals for sediments at the Site (see Table 6-1).

Table 6-1 Remedial Goals for Sediments at Yosemite Slough

Contaminant of Concern	Remedial Goal	Reference[1,2,3]
PCBs	1,240 µg/kg or less at a given location <u>and</u> an overall area-weighted average, (Sitewide) must be 386 µg/kg or less (corresponding to a human health risk level of 3×10^{-6})	HPNS F Parcel F FS and response to Regulatory Agency Comments on the FS.
Lead	436 mg/kg or less at a given location <u>and</u> overall area-weighted average of 218 mg/kg or less	NOAA ERM

Notes:

1 As explained in Section 4, the remedial goals for PCBs at Yosemite Slough are based on exposure point concentrations to ecological receptors within the biological active zone (BAZ). For purposes of this EE/CA, EPA has determined the Site BAZ to be the top 6-inches of sediments with an additional 18 inches for a conservative margin of safety. Therefore the RGs in Table 6-1 only apply to the top 2 feet of Site sediment and are not directly comparable to sediment beneath 2 feet to predict an unacceptable risk.

2 The lead RG at Yosemite Slough will be applied post response action as a not-to-exceed (NTE) and an area-weighted average (AWA) Sitewide within the BAZ. Application of this value as an AWA is consistent with the COC selection in Section 3 of this EE/CA which evaluated average (i.e., 95% UCL of the mean concentrations).

3 A risk-based, not-to-exceed value for lead was not available for the BAZ at this Site. The not-to-exceed remedial goal for lead presented above represents a value of twice the area-weighted average concentration of 218 mg/kg.

Key:

ERM = effects range median
NOAA = National Oceanic and Atmospheric Administration
mg/kg = milligrams per kilogram
PCB = polychlorinated biphenyl
FS = Feasibility Study

The sediment cleanup goal for PCBs is based on the preliminary RG adopted by the Navy. This goal was derived from ecological risk assessment work completed for Parcel F of the HPNS and the greater San Francisco Bay, and was found to be protective of human health. See Section 4 for more information regarding the exposure pathways and assumptions used during the Navy risk assessments.

Although lead was considered a COC, the Navy did not establish a remediation goal for lead in the HPNS Parcel F FS. The EPA has elected to use the NOAA effects range median (ERM) as the basis of the cleanup goal for lead at Yosemite Slough. To develop ERMs, the NOAA compiled a large database of sediment studies and defined the ERM values as the 50th percentile value, which is representative of contaminant concentrations above which adverse effects to the benthic community frequently occur (NOAA 1999). The NOAA ERM of 218 mg/kg lead is being applied Sitewide on an AWA basis for the protection of the benthic community. The EPA selected a not-to-exceed threshold for lead of 436 mg/kg, which is twice the NOAA ERM value, to prevent the occurrence of lead “hot spots” within the Site BAZ that could result in a sub-area of increased exposure and risk.

The analytical data for the surface and subsurface sediment samples down to 2 feet shown in Figure 3-2 were compared with the screening level and background values. The results were plotted on a series of maps presented in Figures 3-3 and 3-4 in order to better understand the distribution of the COCs in the BAZ (and an 18-inch buffer zone below the BAZ) and to assess the concentrations of the COCs in relation to the RGs. Figures 3-3 and 3-4 present exceedences of the RGs down to 2 feet. Other chemicals found at the Site are co-located with the above listed COCs. Hence, once the cleanup goals for the COCs listed in Table 6-1 are met, the cleanup action shall be considered fully protective of both humans and ecological receptors.

7 Screening of Technologies and Development of Removal Action Alternatives

According to CERCLA regulations 40 CFR 300.415, the purpose of an EE/CA is to analyze potential removal action alternatives based on current site conditions to address contamination present at a site. The alternatives are evaluated and developed employing the criteria specified in the EPA documents *Guidance on Conducting Non-Time-Critical Removal Actions under CERCLA* (EPA 1993) and *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites* (EPA 2005). Specifically, each removal action alternative has been developed and analyzed against the RAOs and evaluation criteria separately.

The development and analysis of removal action alternatives involves the following four steps:

1. Identification of broad categories of potential cleanup actions;
2. Identification and screening of the broad array of technologies that may apply to each category;
3. Assembly of identified removal action categories and technologies into removal action alternatives; and
4. Analysis of removal action alternatives against the evaluation criteria.

In this section, the technologies that would be applicable for this removal action are identified, described, and screened. This preliminary screening procedure has been conducted to identify those technologies applicable to the Site that will be effective in meeting the RAOs. After this initial technology screening process, this section presents the technologies retained assembled into removal action alternatives. Section 8 presents a detailed analysis of the alternatives using the criteria of effectiveness, implementability, and cost. Finally, Section 9 provides a comparative analysis among the alternatives and summarizes the recommended alternative.

7.1 Identification and Screening of Management and Treatment Technologies

In accordance with EPA guidance (1993), "only the most qualified technologies that apply to the media or source of contamination" need to be considered for the development, comparative evaluation, and selection of removal action alternatives. The following lists the broad categories of cleanup actions and technologies that are applicable to the Yosemite Slough:

- No Action;
- Institutional Controls (ICs);
- Monitored Natural Recovery (MNR) and Enhanced MNR (EMNR);
- In-Situ Sediment Treatment;
- Sediment Capping;
- Sediment Dredging;
- Sediment Dewatering; and
- Transportation and Disposal of Contaminated Sediment and Materials.

7.1.1 No Action

The No Action alternative leaves contaminated material at the Site in its current condition and assumes no further intervention would occur. Although "no action" would not actively meet the RAOs for the Site, its consideration and evaluation is required by CERCLA and its implementing regulations. The No Action Alternative will be used as a baseline for comparison with other action alternatives. Under this technology, no response activities or monitoring would occur at the Site and does not require the use of any management or treatment technologies.

Site-Specific Evaluation: Although the No Action alternative would not meet the RAOs, it is used as a baseline against which other alternatives are measured. For this reason, it is retained for further evaluation.

7.1.2 Institutional Controls

ICs are non-engineered controls, such as administrative and legal (deed) restrictions, that help minimize the potential for human and ecological receptor exposure to contamination and protect the integrity of the remedy. They may include site use restrictions, such as restrictions on use of boats with propellers, use of anchors at the Site, and limitations on public use of the Site. Fish advisories are a common element of ICs at water-based sites where fishing may occur. Fish consumption advisories can be an effective method for limiting human exposure when fish taken from a particular waterbody contain levels of pollutants that exceed recommended intake levels. These advisories are issued in several forms, including a comprehensive Site-specific consumption guide or a general listing of state waterbodies and their associated consumption advice. Advisories can be issued to either the general population or focused sensitive subpopulations potentially at greater risk (e.g., children, pregnant or nursing women, environmental justice communities with multiple exposures to contaminants) to restrict or avoid consumption of specific species of fish and other wildlife caught locally from specific waters or waterbody types. All advisories are publicly available through the EPA waterbody types Web site (http://www.epa.gov/waterscience/fish/).

Administrative and legal controls do not actively address site contamination, but attempt to meet the RAOs by reducing the potential for exposure by humans to the contaminated material, or by restricting activities that may have adverse effects on in-place remedies that do address RAOs, such as sediment caps. ICs do not directly address ecological risk, but may reduce such risk by restricting Site land uses to discourage or reduce future use by ecological receptors. ICs are generally combined with other removal actions.

Site-Specific Evaluation: ICs alone will not sufficiently address the RAOs. ICs, if not used in conjunction with an active technology, would not be protective of human health and ecological risks and would not address the potential for off-site migration of the contamination. ICs may potentially conflict with the future beneficial uses of the Site. However, if combined with an active technology, ICs can be used as a tool to enhance the ability of a remedy to achieve the RAOs. ICs appropriate for the Site may include Site use restrictions, informational signs, and Site patrols. These ICs would be disseminated to the general public via information prepared by the State Parks about the acceptable activities at the CPSRA. State Parks signage could identify key activity restrictions in Yosemite Slough as well. Site patrols, likely staff of the CPSRA, would check for compliance with the use restrictions selected for the Site. ICs are retained as a remedial technology to be applied in conjunction with other technologies.

7.1.3 Monitored Natural Recovery

As described in EPA's *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites* (EPA 2005), MNR uses ongoing, naturally occurring processes to contain, destroy, or reduce the bioavailability or toxicity of contamination in sediment. Physical, biological, and chemical mechanisms may act together to reduce the risk posed by the contamination, and risk reduction may occur in a number of different ways. As noted by EPA (2005), "Natural processes that reduce toxicity through transformation or reduce bioavailability through increased sorption are usually preferable as a basis for remedy selection to mechanisms that reduce exposure through natural burial or mixing-in-place because the destructive/sorptive mechanisms generally have a higher degree of permanence. However, many contaminants that remain in sediment are not easily transformed or destroyed. For this reason, risk reduction due to natural burial through sedimentation is more common and can be an acceptable sediment management option."

The EPA guidance states that MNR should be considered as a viable remedial alternative alongside capping and dredging at all sediment sites, and should receive detailed consideration when site conditions are especially conducive to MNR, including when:

- Sediment bed is relatively stable and likely to remain so; and
- Contaminant concentrations are moving towards risk-based goals on their own.

Site-Specific Evaluation: Two previous studies evaluated the potential for sedimentation within Yosemite Slough. The Navy reports sediment accumulation rates in South Basin in two reports: Appendix M of the Parcel F Validation Study Report (Barajas and Associates, Inc. 2005) and Appendix E of the Parcel F FS Data Gaps Technical Memorandum (Battelle, Neptune & Company, and Sea Engineering, Inc. 2007). These reports estimate approximately 6 to 8 cm/yr of sediment accumulation based on radioisotope data from two locations within the Slough. However, the Navy qualifies this estimate by stating that the dates and sediment accumulation rates determined for the cores from Yosemite Slough should be considered unreliable given the disrupted radioisotope profiles. With respect to South Basin portion of Parcel F, the Navy concluded that average sediment accumulation rate based on three cores collected in South Basin was estimated to be about 1 cm/yr.

The September 2005 Hydrodynamic Modeling, Wave Analysis and Sedimentation Evaluation for the State Parks Yosemite Canal Wetland Restoration Project Report found the western and central portions of Yosemite Slough to be low energy environments with minimal deposition and erosion potential. Toward the eastern portion of the Site (the mouth of the slough) tidal energies appear to increase which elevate erosion potential. At this time, the EPA believes the generally accepted sediment bed change in most of Yosemite Slough to range between -1.0 cm/yr (sediment scouring) and 0.5 cm/yr (sediment accumulation) as a result of tidal fluctuations and tidal flows. As stated in Section 2.6, the actual hydrodynamics of the slough in its post-wetlands restoration configuration are unknown, and represent a data gap with regards to the potential for deposition, erosion or scour within the Slough. Therefore, the EPA will require additional hydrodynamic modeling of Yosemite Slough during the cleanup action design stage to better estimate net erosion potential within the Site based on the current and future projected geometries of the slough.

As described in Section 3.3.3, a significant decrease in organochlorine pesticide concentrations in the Yosemite Slough were observed in samples collected from 1998 to 2000 and samples collected in 2009 and 2012. Results from the most recent sampling events serve as a line of evidence that natural recovery mechanisms are currently active at the Site.

In summary, based on the Navy and State Park's sedimentation studies, it is unclear whether net sedimentation occurs throughout Yosemite Slough. Sedimentation in Yosemite Slough appears to be complex, variable and additional sedimentation studies are needed before definitive conclusions can be made regarding long-term sedimentation trends. Due to the uncertainty suggested by these studies and the lack of additional available data at this time, it may be difficult to confirm that apparent sedimentation within Yosemite Slough that appears to be reducing surface concentrations of COCs in some areas of the Site is the result of natural sedimentation or other sediment transport processes (i.e., scour/dispersion and re-deposition).

Figures 3-3 and 3-4 (COC distribution in top 2 feet of Site sediment) indicate that, based on the 2009 EPA dataset, significant portions of the 0 to 1-foot horizon already achieve Site RGs. As explained above, the mechanism responsible for this finding is not clear, but may be studied further during the response action design when the conceptual site model is updated. If during the design stage the natural processes which cause clean sedimentation to accumulate in the 0 to 1-foot horizon are specifically identified, the Site response action should integrate and encourage the natural processes, which ultimately reduce risk to human health and the environment.

MNR is less intensive and costly to implement than other removal-based remedial technologies, such as dredging or capping. MNR would not be disruptive to Site ecology and would not have short-term impacts to the nearby community during implementation, as other more construction-intensive remedies would. However, as MNR occurs at a slow rate, time to achieve risk-based RAOs may be longer than for other technologies and the duration of the risk exposure and IC's restricting public recreational opportunities allowed under the CPSRA General Plan in Yosemite Slough (e.g., swimming, windsurfing, fishing, or shell fishing) would likely be considerably longer.

Future storm events and related scour and redeposition of Site surface sediments will need to be considered in the design of any remedy, including evaluating whether MNR should be incorporated as a remedy component. During the period before Site RGs and RAOs are achieved, additional Site monitoring and ICs (e.g., prohibitions on recreational activities including fishing or shellfish collection) would be required to ensure an MNR remedy is protective during the short-term. These ICs may conflict with the potential beneficial uses of the Site.

Enhanced MNR (EMNR), which includes placement of an appropriately designed clean thin sand layer to advance the natural sedimentation process and shorten the duration to achieve Site RGs and RAOs, may be an appropriate option for certain portions of Yosemite Slough. For example, EMNR may be best suited for Site locations where Site sediments are marginally above RGs and the short-term impacts associated with dredging are not warranted based on the risks posed by those portions of the Site. EMNR could also be achieved by windrowing (piling) clean material compatible with Slough ecology to be distributed in portions of the Slough using tidal cycles.

Based on the above discussion, because MNR may only occur at some locations within the Site, implementation of this technology as a stand-alone alternative is not preferable. Additional studies during the design stage may identify the natural processes which cause clean sedimentation to accumulate. If such findings occur, then the Site response action should integrate and promote those natural processes which ultimately reduce risk to human health and the environment in the long-term. In any case, MNR must be combined with an active remedial technology to achieve Site-specific RAOs. Because EMNR involves the immediate placement of thin-layer clean cover, short-term effectiveness is provided while the protectiveness of natural recovery process can augment the protectiveness of the thin-layer cover in the long-term. Based on these reasons, both MNR and EMNR are retained as technologies for further evaluation in a multi-technology approach for the Site.

7.1.4 In Situ Sediment Treatment

As stated in the EPA Contaminated Sediment Guidance, in situ treatment is an approach that involves the biological, chemical, or physical treatment of contaminated sediment in place. Potential in situ biological treatment includes the enhancement of microbial degradation of contaminants by the addition of electron acceptors (e.g., oxygen, nitrate, sulfate, and hydrogen), electron donors (e.g., organic carbon) or nutrients, or microorganisms into the sediment. Chemical treatment includes the destruction of contaminants through oxidation and dechlorination processes by providing chemical reagents into the sediment; and physical treatment includes solidification, stabilization, or sequestering of contaminants by adding activated carbon or phosphate minerals.

Additives, such as coal, coke breeze, portland cement, fly ash, and limestone, can be added the sediment ex situ for encapsulating the contaminants in a solid matrix and/or chemically altering the contaminants by converting them into a less bioavailable, less mobile, or less toxic form (EPA 2005).

In 2008, the Environmental Security Technology Certification Program (ESTCP), in coordination with Stanford University, completed a small field-scale project to demonstrate that activated carbon sorbent mixed with sediment is a cost-effective, in situ, non-removal, management strategy for reducing risk and the bioavailability of PCBs in offshore sediments in Parcel F of the Hunters Point Shipyard site (USDOD ESTCP 2008). The EPA understands that the Navy intends to undertake additional tests of this technology in Parcel F prior to making a recommendation on its effectiveness.

Site-Specific Evaluation: Of the in situ treatment options listed above, introduction of activated carbon is the most applicable technology to address the

PCB contamination at the Site. In situ stabilization, while it may address the PCB COCs, would not result in a viable substrate for recolonization of the benthic community, and in situ stabilization and chemical treatment have not been demonstrated to be implementable or effective on a similar scale to Yosemite Slough. Although in situ treatment with activated carbon would target the chlorinated compounds present in the sediment at the Site (e.g., PCBs); however, this technology is not expected to achieve Site RAOs as the inorganic COCs (e.g., lead) are not targeted by this technology. This technology has been applied at a pilot scale for a number of sites, but has not yet demonstrated long-term effectiveness. For these reasons, in situ treatment with activated carbon is not retained for further consideration.

7.1.5 In Situ Sediment Capping

In situ capping refers to the placement of a subaqueous covering or capping of clean material over contaminated sediment that remains in place. Caps are generally constructed of clean sediment, sand, or gravel. A more complex cap design can include geotextiles, liners, and other combinations of permeable or impermeable elements in multiple layers. Reactive caps may include additions of material to attenuate the flux of contaminants (e.g., organic carbon). Depending on the contaminants and sediment environment, a cap is designed to reduce risk through the following primary functions (EPA 2005):

- Physical isolation of the contaminated sediment sufficient to reduce exposure due to direct contact and to reduce the ability of burrowing organisms to move contaminants to the surface;
- Stabilization of contaminated sediment and erosion protection of sediment and cap, sufficient to reduce re-suspension and transport to other sites; and/or
- Chemical isolation of contaminated sediment sufficient to reduce exposure from dissolved and colloidally bound contaminants transported into the water column.

Caps may be designed with different layers to serve these primary functions, or in some cases a single layer may serve multiple functions. Capping sometimes requires partial sediment removal prior to cap placement when there is a need to preserve the existing sediment elevation for habitat, navigation, bank stabilization, or flood control.

Site-specific evaluation: At Yosemite Slough, in situ capping is a fully implementable technology and may be less disruptive of local communities than dredging or excavation. Land-based facilities will be required for materials handling, for both the cap material and for dewatering and handling of any material removed from the Site so that the existing bathymetry is maintained. In situ capping may be less costly compared to full sediment removal because the volume of material removed is less than with a full removal alternative, though much of the same infrastructure is required for installing a cap. A capping remedy would be able to achieve risk-based RAOs relatively quickly. A well-designed and well-placed cap should more quickly reduce the exposure of fish and other biota to contaminated sediment as compared to dredging, as there should be no or very little contaminant residual on the surface of the cap. Also, the cap often provides a clean substrate for recolonization by bottom-dwelling organisms (EPA 2005). Attributes of a well-designed cap can achieve provisions for habitat restoration, bank stability, and near-shore wading. Cap design includes a number of factors, including protection of the BAZ, potential for mixing during placement, potential for consolidation, and potential for erosion. Additional studies may be necessary during the design phase to determine the cap thickness that would be required for each of these cap design components.

The major limitation of in situ capping is the contaminated sediment remains in the aquatic environment where contaminants could become exposed or be dispersed if the cap is significantly disturbed or if contaminants migrate upward through the cap. Habitat restoration RAOs would take time to achieve and, as the water body is shallow, it may be necessary to implement ICs that would place restrictions on Site uses, such as anchoring or excavation. Long-term maintenance and monitoring would be required to make sure that the cap is performing as intended. Finally, to maintain existing bathymetry, some of underlying sediment would need to be removed to install the cap.

This technology is retained for inclusion in the alternatives.

7.1.6 Dredging

Environmental dredging is intended to remove sediment above certain action levels while minimizing the spread of contaminants to the surrounding environment during dredging (EPA 2005). By removing contaminated sediment from the aquatic environment to achieve the cleanup levels for the Site, long-term effectiveness of the remedy would tend to improve as well as minimize the volume of contaminated sediment in the environment. However, dredging may be more complex and costly than other remedial approaches due to the physical characteristics of the Site, such as requirements for staging areas, Site access, equipment maneuverability and accommodations for various constraints, such as utilities, surface and submerged structures, overhead restrictions. In addition, dredging can cause or contribute to inadvertent resuspension, migration and spreading of contaminated sediment in the water body, including potential recontamination of neighboring areas that have undergone restoration, such as the State Parks wetlands restoration areas and Navy planned wetlands in Parcel E-2 at Hunters Point Naval Shipyard. Dredging also creates a waste volume that requires treatment, transportation, and off-site disposal.

Two remedial objectives for the project include removal of a minimum thickness of contaminated sediment and restoration of the Slough to the existing bathymetry. Given the difficulty in dredging, handling and sidewall control of fully saturated sediments, the dredge removal contractor will be provided a minimum dredge removal thickness and a maximum dredge tolerance. The dredge tolerance is the depth of sediment which may be removed below the minimum target zone as per the project specification. A dredge tolerance assures the Contractor that removal of a portion of the dredge area to a depth greater than the minimum dredge depth. A reasonable dredge tolerance of 10 cm is proposed at this time and would be reconsidered during the remedy design stage. The dredge tolerance thickness is included within the project costs as additional material that is removed and disposed of. As an example, if the minimum removal depth is 30 cm, the project costs allow for removal, disposal and replacement of a 40 cm sediment thickness.

Contaminated sediments can be dredged using one of three methods indicated below:

- Mechanical (wet);
- Mechanical (dry); or
- Hydraulic.

Mechanical Dredging (Wet)

Mechanical dredging in the wet consists of removing the sediments through the water column. The commonly used mechanical dredges in the United States (EPA 2005) are: clamshell, enclosed bucket, and articulated mechanical. The clamshell dredge is a wire supported, conventional, open clam bucket that has a circular shaped cutting action while the enclosed bucket dredge is a wire-supported, near watertight or sealed bucket as compared to an open clam bucket. The articulated mechanical dredge has a backhoe design with a clam-type enclosed bucket and hydraulic closing mechanism, all supported by an articulated fixed-arm.

The dredged sediment may be directly loaded into barges, which are then transported to the staging/processing area. There is high potential for re-suspension of contaminated sediments into the water column during the removal process. Turbidity controls, such as turbidity curtains, or water control structures installed for water control or sediment stability during removal, such as a berm or sheet pile walls, can be used to manage turbidity. Also, dredging residuals (i.e., sediment that settles onto the dredge surface after it has been resuspended, or sediment not removed during dredging operations) are more likely to remain following dredging and may need to be addressed, typically through placement of a thin layer of clean granular backfill.

Site-specific Evaluation: Mechanical dredging is a commonly used technology that can be readily implemented. This technology has good potential to achieve RAOs for the Site; however, dredging residuals may cause the resulting surface sediment to have concentrations at or higher than the surface sediment prior to removal. Due to shallow water and the tidal fluctuations at the Site, often leaving the mudflats exposed, significant infrastructure (i.e., berms or sheet pile walls) would be required to conduct dredging in the wet as the water would need to be held at a relatively constant elevation with sufficient draft for equipment to work.

However, due to the shallow bathymetry of the Site, dredging would require construction of a channel in the south basin for dredge equipment access and dredging operations, thus, generating additional contaminated material for handling and disposal. Construction of a channel may be complex due to the presence of utility crossings and debris. Mechanical dredging (wet) would be costly and would also require infrastructure, such as docks and offloading areas. Due to the reasons mentioned above, this technology would only be retained as a "maximum effort alternative" for comparison purposes and would be evaluated as part of a multi-technology alternative.

Mechanical Dredging (Dry)

Mechanical dredging "in the dry" involves excavation of sediment after isolating the sediment from the water column using water control structures, such as berms or steel sheet pile walls to divert the water from the excavation area. The area would be isolated using one or more of the following technologies: sheet piling, earthen dams, cofferdams, geotextile tubes, and inflatable dams. The feasibility and cost of hydraulic isolation of the dredging area during remediation is a major factor in selection of dredging in the dry. Once isolated, standing water within the excavation area would be removed by pumping. Any continuing inflow due to seepage from groundwater or through the water control structures must be managed throughout the process, typically by automated pumping systems. Management of water within the confined area is another important logistical and cost factor that could influence the decision of wet versus dry removal techniques.

Isolation and dewatering of the area would normally be followed by excavation using conventional earthmoving equipment, such as an excavator. Supporting the excavation equipment in the dewatered area, where sediment is soft, could be problematic because underlying materials may not have the strength to support equipment weight. This also may reduce excavation depth precision. Both factors should be accounted for during the design phase. When the excavation activities are complete, temporary dam(s) or sheet piling(s) are removed, and the water body would be restored to its original hydraulic condition.

Site-specific Evaluation: Mechanical dredging in the dry is a commonly used technology that can be readily implemented and this technology has a high potential for achieving risk-based RAOs and ARARs for the Site. Mechanical dredging in the dry would be accomplished by isolating the Yosemite Slough from the bay and dewatering the area. Standard construction equipment would then be used to remove the sediment, loading directly into dump trucks for transport to the staging/processing area. Much of the excavation would be done from the shoreline or by placing temporary mats for the equipment to enter the Site.

By conducting the work in the dry, the potential for re-suspension and releases of contaminants to the water column would be reduced and the residuals would be easier to manage. This technology could have significant costs, depending on the methods used to isolate the work area. Management of water would be required throughout the process to keep excavation areas dewatered. This technology may only be applicable in certain areas of the Site. It may not be viable to perform mechanical removal in the dry in the mouth of the slough, due to the deeper water depths and shallow bedrock (making sheet pile walls more difficult to install) in that area. This technology will be retained for further evaluation as a stand-alone alternative, as well as a component of a multi-technology approach.

Hydraulic Dredging

Hydraulic dredges remove and transport sediment in the form of a slurry through the inclusion or addition of high volumes of water at some point in the removal process (EPA 2005).

The excess water is usually discharged as effluent at the treatment or disposal site and often needs treatment prior to discharge. Hydraulic dredges may be equipped with rotating blades, augers, or high-pressure water jets to loosen the sediment (EPA 1995). The applicable hydraulic dredges for the Site are the following (Palermo et al. 2004):

- Cutterhead: Conventional hydraulic pipeline dredge, with conventional cutterhead;
- Horizontal auger: Hydraulic pipeline dredge with horizontal auger dredgehead (e.g., Mudcat); and
- Plain suction: Hydraulic pipeline dredge with dredgehead design with no cutting action, plain suction (e.g., cutterhead dredge with no cutter basket mounted.

Site-specific Evaluation: Hydraulic dredging is an effective, well understood method of removing contaminated sediments. This technology has a high potential for achieving risk-based RAOs and ARARs for the Site. Hydraulic dredging would be accomplished by using a standard hydraulic dredge mounted on an amphibious vessel that would pump the slurry of removed sediments directly to geotextile tubes in the staging/processing area.

Implementation of this technology would increase the potential for resuspension and releases of contaminants to the water column. It would also result in the generation of dredging residuals that would need to be addressed. This technology generates a significant wastewater stream for processing/treatment. Costs could increase if significant debris is encountered at the Site, as hydraulic dredging is not well suited to handling the presence of debris. Hydraulic dredging also has similar limitations as mechanical dredging in the wet, as water control structures would need to be installed to retain water in the Slough during low tide, so the hydraulic equipment could operate. Therefore, this technology may only be viable in certain areas of the Site, similar to mechanical dredging in the wet. For these reasons, this technology would only be retained as a “maximum effort alternative" for comparison purposes and would be evaluated as part of a multi-technology alternative.

7.1.7 Management and/or Treatment of Contaminated Material

This section provides a brief description of the following management and treatment technologies for contaminated material considered for the Site:

Sediment Dewatering

Depending on the removal method selected, the dredged sediment will likely need dewatering once it is transported to a staging/processing area prior to disposal. The drained water would typically be directed into a sump and then pumped to a treatment system for treatment prior to disposal. The typical dewatering methods considered are:

Passive Dewatering. Passive dewatering involves the placement of excavated sediments into a bermed lagoon where the sediments are left to dewater naturally. As entrained water gravity drains from the sediment, the water must be removed or isolated. Polymers or other flocculants can be used to accelerate the dewatering process. When the sediments are sufficiently dry they are removed and loaded directly into trucks/rail cars for transportation off-site.

Stablization. Stabilization is achieved by adding chemicals, such as a polymer, lime or cement, to the excavated sediments. This is not truly a dewatering process, as it does not remove water from the sediment, but it can be used to decrease water content for upland disposal requirements.

Mechanical Dewatering. Mechanical dewatering involves the uses of mechanical equipment, such as cyclones, centrifuges, filter presses, or other systems to physically remove the excess water in the sediment. The sediment is often liquefied and pumped into the mechanical treatment system. Mechanical operations, such as pressure or centrifugal force separates the entrained water from the sediments. After a set period of time the dewatered sediment is removed from the dewatering unit and processed for off-site disposal via trucks/rail cars.

Passive Dewatering within a Geotextile Containment Unit (Geotextile Tube). Passive dewatering may be conducted within geotextile containment bags. Liquefied sediment slurries are hydraulically pumped into geotextile bags under low pressure, often times in combination with a chemical flocculant. Sediments remain trapped within the geotextile, while water is allowed to filter through the geotextile into a containment area. The sediment is allowed to gravity dewater within the bags for a period of days to weeks. Following dewatering, when the sediment reaches an acceptable moisture content, the geotextile tubes can be loaded directly into trucks/rail cars for transportation off-site, or they can be split open and the material excavated and placed into trucks/rail cars for transportation off-site.

All of the sediment dewatering methods are retained. Depending on the dredging technology selected for the Site, one or more sediment dewatering methods would be used. Possible locations for the sediment dewatering processes include the Candlestick Park Parking Lot (to the southeast of the site), and SF Port facility (approximately 1.5 miles northeast of the site). Barges are a viable option for transport locally at the Site (to SF Port facility), but are not feasible for transport directly to a disposal facility. Pipelines could be used to transport hydraulically dredged sediment to either processing area. Trucks could be used to transport the dewatered sediments from the processing areas to the final off-site disposal landfill or to a railhead for transfer to rail cars. The nearest railhead for the Parking Lot processing area is located at Pier 90, which serves RCRA hazardous and TSCA waste landfills only. The SF Port facility has access to a railhead directly at the pier. Figure 7-1 identifies the sediment dewatering area and potential truck haul routes to landfills. Figure 7-2 presents potential alternate sediment dewatering area and the corresponding truck/rail haul routes to landfills.

With any dewatering technology, the potential for generation of odors during the process should be considered and evaluated.

Transportation/Disposal

Transportation/disposal involves moving sediment from the excavation/dredging areas to the staging or disposal site as well as transporting clean backfill sediments to a site. Different modes of transportation may be considered to handle the sediments:

- Pipeline: Direct placement of material from a barge into staging areas using a pipeline is economical and can be accomplished using pumps. The pipeline from the hydraulic dredging barge to the sediment processing location at Candlestick Park parking lot would extend approximately 2,000 feet. A pipeline from the dredging barge to the potential alternate sediment dewatering area at the SF Port facility area (placed underwater and extending around the Hunters Point Naval Shipyard) would extend approximately 5 miles.

- Truck: Dredged material can be handled directly from the barges or mechanical excavators to the roll-off containers or dump trucks for transport to the staging/processing area as well as for transporting from the staging area to disposal facilities. The material would need to be dewatered prior to transport using trucks over streets. To transport dried sediments from the Candlestick Park overflow parking lot dewatering area, the trucks will have to navigate through some residential streets immediately adjacent to the Site, around the eastern portion of Candlestick Park to join Highway 101 to transport the material to off-site disposal landfills. Haul routes to and from both the Candlestick Park overflow parking lot and the SF Port facility area are provided in Figures 7-1 and 7-2, respectively.

- Barge: Barges could be used in areas where the staging/processing area is located on the shore. Dredged sediment could be loaded onto the barges directly and transported to the staging areas for processing or transported directly to a disposal facility, if a viable disposal facility exists with barge access.

- Railcar: Rail spurs could be constructed to link the Candlestick Park parking lot dewatering area to the existing rail network. Operational rail access already exists at the potential alternate sediment dewatering area at the SF Port facility and could be used for transporting the dredged sediment to disposal facilities.

All of the transport methods are retained. Depending on the dredging technology selected for the Site, one or more transportation methods would be used. Pipelines could be used to transport hydraulically dredged sediment to the staging areas. Trucks could be used to transport the dewatered sediments from the processing area to the final off-site disposal landfill or to the railhead for transfer to rail cars. The nearest railhead at the Site is located at Pier 90, which serves RCRA hazardous and TSCA waste landfills only. Barges are a viable option for transport locally at the Site, but are not feasible for transport directly to a disposal facility.

7.2 Assembly of Removal Action Alternatives

The general response actions and technologies described in the preceding sections have been assembled into seven removal action alternatives that have been analyzed with respect to the evaluation criteria: effectiveness, implementability, and cost. These alternatives have been developed based on the known nature and extent of sediment contamination and results of the human and ecological risk assessments. The No Action Alternative has been included for comparison. The seven alternatives are:

- Alternative 1 – No Action;

- Alternative 2 – Removal of sediments in the top 1-foot interval where COCs exceed RGs, engineered sediment cap, EMNR/MNR and ICs;

- Alternative 3 – Remove sediments in the top 1-foot interval where COCs exceed two times RGs, engineered sediment cap, EMNR/MNR, and ICs;

- Alternative 4 – Remove sediments in the top 1-foot interval where COCs exceed three times the RGs (with three exceptions): engineered sediment cap, EMNR/MNR, and ICs;

- Alternative 5 – Remove sediments in the top 1-foot interval where COCs exceed RGs, continue sediment removal up to 2 feet deep in same areas if COCs exceed RGs, engineered sediment cap, EMNR/MNR and ICs;

- Alternative 6 – Removal of sediments up to 2 feet deep where COCs exceed RGs in the top 2-foot interval, engineered sediment cap, EMNR/MNR and ICs; and

- Alternative 7 – Full removal of sediments where COCs exceed RGs (up to 5 feet deep), backfill, and no ICs.

The seven alternatives listed above provide a broad array of response action alternatives using the sediment remediation technologies that were deemed potentially effective for the Yosemite Slough Site. Alternatives 2 through 7 are multi-technology alternatives that provide a range of both active (e.g., dredging) and passive (EMNR/MNR) technologies and at a wide range of associated costs. Dredge volumes range from 2,500 CY (Alternative 4) to 40,900 CY under (Alternative 7). Dredge volumes associated with the selected alternative will be revised during the design phase once an updated understanding of the dredge boundaries is established and remedy design studies are completed.

Alternative 1 does not achieve Site RGs or RAOs. However, Alternatives 2 through 7 can achieve Site RGs and RAOs immediately after completion of the construction phase of the response action with the exception of Alternatives 3 and 4 which would achieve RGs and RAOs based on the efficiency and duration of the EMNR/MNR component contained in those alternatives. The use of two times RGs (Alternative 3) and three times RGs (Alternative 4) was considered a reasonable range of surface contamination to leave in place while an evaluation on the potential efficacy of EMNR/MNR is conducted.

Alternatives 2 through 7 will have the following common components as described further in Section 8.1:

- Slough bank stabilization;
- Possible CSO outfall apron modification;
- Reasonable upland source control;
- Post removal site control and effectiveness monitoring;
- Odor, noise, dust, and traffic management;
- Dredging and removal of contaminated sediments;
- Sediment processing;
- Water treatment;
- Off-site transport, treatment, and disposal of contaminated sediments;
- Capping or backfilling using cleanup imported sands; and
- Controls for sediment re-suspension.

The remedy components listed above are equally effective and implementable under Alternatives 2 through 7; the unit rates for the costs associated with each of these elements are generally the same under each alternative but vary based on the scope and duration. The cost estimates for each alternative, including the costs of the common components listed above, are present and are identified in Appendix G.

Section 8 presents a detailed analysis of the seven removal action alternatives using the evaluation criteria of effectiveness, implementability, and cost.

Source: Esri 2011, 2011 National Geographic Society

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Figure 7-1
Potential Sediment Haul Routes from Candlestick Park Parking Lot

Yosemite Slough
San Francisco, California

ecology and environment, inc.

M:\Oakland\Yosemite_Creek\Maps\MXD\Report\2012_December\Haul_Routes_Option2.mxd Figure 1-1 Site Location Map

Source: Esri 2011, 2011 National Geographic Society

Figure 7-2
Potential Sediment Haul Routes from Alternative Sediment Processing Area

Yosemite Slough
San Francisco, California

8 Detailed Analysis of the Removal Action Alternatives

The general response actions and applicable technologies described in the preceding sections have been assembled into seven removal action alternatives. These alternatives have been developed based on the known nature and extent of sediment contamination and the results of the human and ecological risk assessments and are described below:

- Alternative 1 – No Action;
- Alternative 2 – Removal of sediments in the top 1-foot interval where COCs exceed RGs, engineered cap, EMNR/MNR and ICs;
- Alternative 3 – Remove sediments in the top 1-foot interval where COCs exceed two times RGs, engineered cap, EMNR/MNR, and ICs;
- Alternative 4 – Remove sediments in the top 1-foot interval where COCs exceed three times the RGs (with two exceptions), engineered cap, EMNR/MNR and ICs;
- Alternative 5 – Remove sediments in the top 1-foot interval where COCs exceed RGs, up to 2 feet in where COCs exceed RGs in both the 0 to 1-foot and 1 to 2-foot intervals, engineered cap, EMNR/MNR and ICs;
- Alternative 6 – Removal of sediments up to 2 feet where COCs exceed RGs in the top 2-foot interval, engineered cap, EMNR/MNR and ICs; and
- Alternative 7 – Full removal of sediments where COCs exceed RGs (up to 4 feet), backfill, and no ICs;

These alternatives are described and evaluated in further detail below. Evaluation of each alternative includes an analysis of effectiveness, implementability, and cost. An explanation of the three evaluation criteria is provided in Figure 8-1.

Alternatives 2 through 7 will have several common components as described in Section 7.2. Section 8.1 provides additional details concerning common components. Section 8.2 presents the detailed evaluation of the seven alternatives.

8.1 Common Components

Alternatives 2 through 7 include sediment removal as a component of their respective layouts so there are a number of common elements among the alternatives. The purpose of this subsection is to present a brief description of these elements to avoid repeating them throughout the alternatives descriptions.

These common elements include:

- Slough bank stabilization;
- Possible CSO outfall apron modification;
- Reasonable upland source control;
- Post removal site control and effectiveness monitoring;
- Odor, noise, dust, and traffic management;
- Dredging and removal of contaminated sediments;
- Sediment processing;
- Water treatment;
- Off-site transport, treatment, and disposal of contaminated sediments;
- Capping or backfilling using cleanup imported sands; and
- Controls for sediment re-suspension.

A more detailed description of these common elements is provided below. Decision regarding the appropriate elements of each common component will occur in the design phase.

8.1.1 Slough Bank Stabilization

Shoreline stabilization refers to actions and materials placed along the landside edge of the dredge activities to prevent shoreline soils from becoming unstable and entering the dredge area. The period of time that the dredge area would be left open without stabilization will be minimized. The shoreline along Yosemite Slough has no structures and is made up of land that was established from prior filling activities. Prior to dredging activities, a shoreline survey will be completed to document the existing conditions along the shoreline. The survey shall document locations of features and locations where existing bank erosion or failure has occurred or is occurring. Shoreline stabilization activities will be accomplished using multiple methods such as placement of coir logs, wooden planks, armor stone or similar. All shoreline areas disturbed during the activities will be repaired by placing erosion control blankets, seeding and/or planting vegetation.

In coordination with the CDPR and the RWQCB, slough bank stabilization activities may also include the design and construction of storm water best management features (e.g., bioswales), the restoration (e.g., plantings, walking trail) in the Phase 3 zone of the CDPR's Yosemite Slough Wetlands Restoration Project.

8.1.2 Possible CSO Outfall Apron Modification

Except for alternatives 1 and 7, the alternatives involve the construction of an engineered cap. Along the Yosemite Slough, there are three existing CSO outfalls that discharge into the Slough. To protect the physical integrity and chemical quality of the installed cap and the biologically active zone across the Site, these three outfall aprons will need to be modified. Modifications will occur on an as needed basis to ensure the chemical quality and velocities of the water flowing out of these outfalls and into the Site do not threaten the protectiveness of the selected cleanup response action. The CSO flow quality and quantities as well as the impacts of these flows on the selected alternative will be evaluated during the design phase. Other potential options, such as diversion of the CSO outfalls, will be evaluated during the design phase.

8.1.3 Reasonable Upland Source Control

Reasonable upland source control efforts will commence during the remedial design and continue thereafter to ensure slough sediments do not become re-contaminated. Some of the upland source control efforts that will be implemented will include:

- Slough bank stabilization (described in Section 8.1.1);
- City of San Francisco agencies (Department of Environment and SFPUC), State environmental agencies, the EPA and key property owners will collaborate on the development of storm water management plans for properties in proximity of Yosemite Slough to ensure overland urban storm water flows do not enter Yosemite Slough and are instead directed to SFPUC storm drains or to best management practices, such as bioswales;
- Continued SFPUC enforcement of sewer industrial pre-treatment rules prior to any sewer discharges;
- Continued SFPUC management of storm water on city streets;
- The SFPUC and EPA to lead efforts to promote proper storm water management on private parcels and streets not owned or managed by the City; and
- City, state, EPA, local non-profits, and the community may initiate collaborative efforts to educate local residences and businesses on the ecological, recreational and public health benefits of a restored Yosemite Slough and the need to protect slough quality and improve surveillance and prevention of illicit dumping near or in Yosemite Slough.

8.1.4 Post Removal Site Control and Effectiveness Monitoring

Following the implementation of the alternatives, long-term monitoring will be required to monitor the effectiveness of the implemented alternative. Except for

Alternatives 1 and 7, the effectiveness monitoring will involve a baseline monitoring event, and regular inspections (including sampling) of the constructed cap to ensure that the installed cap performs as designed and the ICs are enforced. In addition, sediment sites are vulnerable to recontamination during the cleanup work and after the cleanup work due to upland sources or disturbance and re-suspension of any contaminated sediments left in place. Therefore, alternatives that incorporate dredging, capping, or MNR/EMNR shall be subject to a Sitewide effectiveness monitoring program to ensure all RAOs and RGs (identified in Sections 6.1 and 6.2, respectively) are achieved Sitewide. The specific goals, content, and frequency of monitoring would be determined during the remedial design stage.

8.1.5 Odor, Noise, Dust, and Traffic Management

Dredging, staging and dewatering, of contaminated sediments can potentially create air quality (e.g., odor and dust) concerns for the local community. Additionally, alternatives that have off-site transportation of contaminated sediments can cause traffic impacts associated with increased truck activity in the short term.

Air Quality

A project air quality protection program will be developed during remedy design and implemented at the Site during the remedial activities. The program may include the assessment and modeling of potential air quality impacts and identification of potential air quality monitoring, mitigation and contingency action measures to be used during remedial activities. At sediment cleanup projects, the primary potential for dust derives from truck traffic on dirt roads, which will need to be maintained (e.g., use of gravel and/or regularly wetted dirt road). Sediment removed from the slough and staged at the sediment processing area will be wet and cohesive and dust is generally not created. However, appropriate engineering control and corrective actions, such as applying water, can be implemented as necessary if dust problems are encountered. Bad smelling odors can sometimes be generated at sediment remediation sites. Slough sediments are often rich in natural organic matter and its decomposition after removal can sometimes create an unpleasant odor. During the remedy design stage, tests of Yosemite Slough sediments will be conducted to evaluate the potential for odor generation and the associated need for odor mitigation measures. In addition, dredging or sediment dewatering activities have the potential to release toxic chemicals into the air creating a potential risk to site worker safety. The air quality management plan will identify odor, toxic emission and dust triggers under which mitigation and contingency actions must be activated.

Traffic

A traffic management plan will be developed during remedy design and implemented at the Site during remedial activities to comply with the local regulations and will include measures to address the following: protecting existing nearby road features, such as curbs, pavement and utilities; maintaining access for fire-fighting equipment and access to fire hydrants; minimizing disturbance to public travel; minimizing the truck travel in residential areas; requirements for covering loaded trucks and minimizing track-out of dirt or mud onto public streets; and coordinating traffic routing with others working in the same areas. Traffic management will be analyzed during the remedial design stage and methods to reduce or minimize each impact will be developed and integrated into the remedial design documentation.

8.1.6 Dredging

Removal "In the Dry" Using Mechanical Excavators

Mechanical removal in the dry would be accomplished by isolating Yosemite Slough from the bay and dewatering the Site. Prior to dewatering, work area isolation structures as described in Section 7.1.7 would be installed. Selection and design of these work area isolation structures will depend on the selected alternative and how large of an area would require isolation. Based on geotechnical studies performed for Yosemite Slough (ARCADIS 2012), it is likely that portable dams would be most appropriate for smaller removal areas that are farther from the mouth of the Slough, where the water depths are shallower and in areas where the tidal flux completely exposes the mudflats at low tide.

As described in Section 7.1.7, once work area isolation has been installed, standing water within the slough area would be removed and groundwater infiltration control measures would be installed. Currently, additional evaluation of groundwater flow patterns and quality is needed. Pre-remedial design studies targeting groundwater quality and flow would be performed at the Site and methods for managing water within the removal area will be further evaluated during design. Costs for management of groundwater inflows could be significant depending on the quantity of water. Water removed from the work area would be conveyed to the on-site treatment system. In addition to controlling groundwater inflows to the work areas, CSOs with the potential to discharge into the work area would be temporarily diverted.

Standard construction equipment equipped with long reach booms would be used to remove the sediment from within the removal footprint. To allow the equipment to access the excavation areas, temporary timber crane mats would be placed within the Slough and would be relocated as needed. The excavated sediment from the Slough would then be loaded on dump trucks and transported to the staging/processing area for staging/treatment prior to transportation to a landfill.

Removal "In the Wet" with Using Hydraulic or Mechanical Dredging

Sediment removal in the wet would require installation of a work area isolation structure designed to retain water within the Slough with adequate depth to allow for floatation of removal equipment and barges. Results of the geotechnical investigation (ARCADIS 2012) indicate that a more robust work area isolation design would be required for this approach. This would be accomplished by installing a steel sheet pile wall at the mouth of the Yosemite Sough and pumping water into the enclosed area as necessary to maintain the water level within the Yosemite Slough. Because feasibility of this removal method requires a more robust work area isolation structure, this method of removal would be more appropriate for alternatives with larger removal footprints.

With this approach, hydraulic or mechanical removal methods would be feasible. Prior to dredging activities, a debris survey would be performed for areas identified for removal, and large debris would be removed from the Site using long-reach mechanical equipment. Hydraulic dredging would be accomplished by using barge mounted hydraulic dredging technology described in Section 7.1.6. The dredge would pump the sediment slurry through a high density polyethylene pipe directly to the sediment processing facility for screening and dewatering. The pipe route would be determined during the design phase based on the locations of other removal related activities. Mechanical removal would be accomplished using barge mounted long-reach excavators. The sediment would be placed onto barges and then slurred for pipeline transport to the processing site or transited to the upland sediment processing area for offloading, depending on the location of the upland area and whether it was accessible by barges from within the area of work isolation. Due to equipment availability, mobilization logistics, the small work area size and the quantity of water needed for hydraulic dredging processes, it is likely that mechanical dredging would be the most cost effective method for dredging in the wet.

8.1.7 Sediment Processing

The alternatives assume that upland activities associated with the removal activities (i.e., a project staging area and a sediment processing area needed for management and drying of the sediment) would be located immediately southeast of the Site (see Figure 8-2). The assumed sediment processing location is a large overflow parking lot for Candlestick Park (see Figure 8-2). If it is determined during the design stage that odors cannot be adequately mitigated at this sediment processing location, then an alternative processing location will be identified, such as the location shown at the SF Port facility north of the Site (see Figure 8-2). The property or properties used for project staging and sediment processing would need to be leased for access and use during response action implementation. Figure 8-2 presents both potential locations for sediment dewatering, sediment stabilization, and sediment storage prior to off-site transport to landfills. Dredged sediment would be slurried and transported to the staging area via pipeline or offloaded to the staging area from barges, depending on the location of the upland staging area selected.

Alternatives 2 through 7 will have varying upland processing footprint requirements depending on the method of sediment removal, total volume of sediment removed, and dewatering method. To estimate the appropriate footprint for each alternative, preliminary sizing of dewatering units, water treatment units, and stockpiles will need to be evaluated. The process for each type of dewatering method discussed in Section 7 is presented here. The final sediment processing location and the specific method of dewatering will be determined during design, based on the type of dredging method chosen, the amount of upland space available for dewatering, and the quantity of material to be removed.

Mechanical Dewatering

Sediment removed in the dry would be mixed with water pumped from South Basin to create a sediment slurry. The sediment slurry would be passed though mechanical screens to separate smaller debris and vegetation. The resulting slurry will then pass through hydrocyclones to remove granular material. The granular fraction would be stockpiled and gravity dewatered. The resulting water would be pumped to the water treatment system. The remaining fine grained material would be pumped from the hydrocyclones into a rapid mix tank and flocculator where a polymer flocculent would be added. Gravity settling and thickening of the fine-grained material would then occur in a clarifier. The thickened fine-grained material would then be transported to a filter press, belt press, or equivalent. The resulting filter cake would then be stockpiled on-site along with the debris and granular material separated during sediment processing. Process water effluent from the dewatering press would be re-introduced into the rapid mix tank.

Passive Dewatering

Sediment removed using hydraulic dredging would be pumped directly from the dredge into geotextile tubes. Polymer would likely be added during this step to enhance dewatering, as it promotes sediment flocculation and decreases sediment settling time.

The geotextile tubes would be staged on top of an impermeable liner with perimeter berms to contain decant water. Once dewatering within the geotextile tubes is completed, the geotextile tubes would be opened and the material would be staged for disposal. Decant water would be pumped from a sump installed in the bermed liner to the water treatment system.

8.1.8 Water Treatment System

Water collected through site dewatering and sediment processing activities would be pumped to an on-site water treatment system. The water treatment system is expected to include a settling tank, sand filter, bag filter, carbon filters, and a final holding tank for testing and storage. Characterization samples would be collected from the treated process water and analyzed for total dissolved solids, total suspended solids, chemical oxygen demand, metals, and PCBs. For costing purposes, it was assumed that one sample is needed every 10,000 cubic feet of processed water, though the frequency would be determined during design. The treated water then would be discharged to the SFPUC sewer system. It is assumed that compliance with the substantive requirements of ARARs for this action along with the permits, if any, required for the disposal of treated water into the sewer system will be developed during the design phase.

8.1.9 Off-site Transport, Treatment, and Disposal

Sediment would be segregated based on the in situ chemical properties of the materials. As per the waste characterization report (E & E 2012), the samples collected from the Yosemite Slough indicated that none of the sediment within the removal footprint detected PCB concentrations above the TSCA limit of 50 parts per million (ppm). Additionally, the waste characterization results for Yosemite Slough sediment did not indicate TCLP exceedances resulting in federal RCRA hazardous waste status. However, some of the samples exceeded the California TTLC and STLC standards for lead. As a result, sediment will be segregated into two groups: sediment classified as non-hazardous by the state of California and sediment classified as hazardous by the state of California based on lead concentrations.

To reduce the sediment disposal costs associated with handling and disposing sediment classified as California hazardous waste due to elevated lead concentrations, the lead-impacted sediment will be treated using a stabilization product to convert it into non-hazardous sediment prior to disposal. The solidification/stabilization process will include the addition of a chemical treatment product to stabilize the metal contamination. After stabilization, the lead-impacted sediment would be sampled to determine the appropriate disposal location, and subsequently shipped off-site to that landfill.

The possibility of using portland cement as a treatment product was evaluated and rejected because of the alkaline nature of the product and the need for high dosages (10 to 100%) to achieve the low California STLC/TTLC standards. For the purposes of this EE/CA, it is assumed that a proprietary treatment product would be necessary, such as a chemical product from EnviroBlend®, to stabilize the sediment. A dosage of approximately 1 to 3% weight of compound/weight of sediment has been assumed for the purposes of the EE/CA. Bench-scale studies would be necessary during the design phase to identify the appropriate chemical treatment product needed for treating the lead concentrations in the sediment.

The non-hazardous sediment material would be directly loaded after dewatering and transported by truck to one of several local landfills. Glen Canyon Landfill, Altamont Landfill, Vasco Road Landfill, and Keller Canyon Landfill are the closest Subtitle D Landfills to the Site, and transportation by truck is the most cost-effective solution.

8.1.10 Engineered Cap

Following removal activities, if subsurface sediment required capping based on COC concentrations, an engineered cap would be placed over the removal footprint. In areas where deeper sediment does not exceed RGs, backfill would be placed to return the mudline to its pre-removal elevation. The purpose of the cap would be to isolate impacted sediment left in place from likely receptors, as described in Section 7.1.

Standard of practice for cap design has been developed by the USACE (2001). Methodology for designing cap thickness, known as the Palermo algorithm, includes evaluation of physical and chemical properties of native sediment and cap material (Palermo et al. 1998). The Palermo algorithm states that total cap thickness is determined as the sum of the thickness of the following individual cap components:

- **Bioturbation** – Bioturbation depth is the zone through which benthic organisms mix and disturb sediment. The cap thickness for bioturbation is determined based on the sediment depth associated with organisms that live or feed in the BAZ at the Site to be capped.
- **Consolidation** – Consolidation in a capping context results from both the compression of the underlying sediment on which the cap is placed as well as the settlement and compression of the cap material itself for a period of time after placement. The cap thickness for consolidation is determined based on geotechnical parameters associated with the cap material and/or underlying native sediment.
- **Erosion** – The cap thickness for erosion as a result of long-term continuous processes is determined based on site-specific hydrodynamics.
- **Operational Considerations** – Operational considerations include limitations of the equipment used to place the cap material, the water depth through which the material is placed, the specified tolerances to which the cap must be placed, and even the cap thickness itself (as thinner layers of material are more difficult to place). Long-term Site use must also be considered and accounted for, such as the potential for anchoring within the footprint of the cap, which could result in disturbances. The cap thickness for operational concerns is determined based on additional protective measures required for these types of considerations.
- **Physical/Chemical Isolation** – The necessity of a cap to provide physical and/or chemical isolation (e.g., using granular activated carbon) beyond what is accounted for in the layers discussed previously is determined based on advection and/or molecular diffusion flux of contaminants through the cap materials to the water column, and whether that flux requires a more significant thickness than is already designed for in the layers listed above.

Depending on the specifics of the Site, the in situ sediment, the COCs, and the sediment stability, many of these layers can serve multiple functions, reducing the overall thickness of the cap. To maintain current bathymetry within the Yosemite Slough, the cap thickness would not extend above the current bathymetry elevation, so sufficient sediment would need to be removed to allow for cap placement. A preliminary evaluation of cap thickness was completed using the Palermo algorithm, and for purposes of this EE/CA the required cap thickness is assumed to be 1 foot. However, cap thickness and associated dredge volumes will likely be revised during the design phase once an updated understanding of the dredge boundaries and cap properties are established. For example, it may be determined by the EPA that cap thickness may be increased or decreased (based on new information collected during the design stage) while required Site RGs and RAOs are maintained with a high degree of effectiveness.

Clean dredge material excavated from the San Francisco Bay could potentially be used to construct the cap, based on available sources and results of material testing showing that the material is suitable. Alternate cap material sources could include upland borrow pits. For this EE/CA, it is assumed that clean material dredged from other areas of San Francisco Bay is appropriate for use as cap material.

Restoration of Yosemite Slough would be performed following cap placement activities. The type, location and placement of habitat features within the slough would be decided during the design phase.

8.1.11 Controls for Sediment Resuspension

Construction best management practices (BMPs), such as operational controls and specialty equipment, would be used during the dredging activities to reduce potential contaminant release and migration. To minimize the potential for sediment resuspension, silt curtains may be installed during sediment removal activities within the Slough. Due to bidirectional flows from tidal fluctuations, challenges to minimizing the migration of sediment may arise. The exact methods, sensitive areas to be protected (e.g., state parks wetlands restoration areas, HPNS Parcel F, and remediated zones within the Site), and final layout of the curtains to be used to reduce potential sediment suspension will be assessed during the design phase.

8.2 Detailed Evaluation of Alternatives

8.2.1 Alternative 1: No Action

Alternative 1 serves as a baseline against which overall effectiveness of the active Removal Action alternatives can be compared, as required under CERCLA. Under this alternative, no activities would be implemented to remove, treat, contain, or monitor sediment contaminants in Yosemite Slough.

Evaluation of Alternative 1

<u>Effectiveness</u>

This alternative would not be effective in protecting human health or ecological receptors, would not attain ARARs, and would not meet RAOs.

<u>Implementability</u>

Technical and administrative feasibility criteria do not apply to the No Action Alternative.

<u>Cost</u>

There are no costs associated with this alternative.

8.2.2 Alternative 2: Remove Sediment in the Top 1-foot Interval Where COCs Exceed RGs, Engineered Cap or Backfilling, EMNR/MNR and ICs

Alternative 2 consists of a combination of dredging, capping, backfilling, and ICs. Under this alternative, surface sediment from 0- to 1-feet below BSS that exceed RGs would be removed, a 1-foot-thick engineered cap would be installed within the footprint of the 0 to 1-foot removal areas. As a supplementary, optional component to this alternative, EMNR/MNR may be implemented as needed in portions of the Site where the BAZ is marginally above RGs as determined by the EPA. Use of EMNR/MNR will be subject to EPA pre-approval, based on EPA risk management principles, and only in locations where technical design evaluations indicate EMNR/MNR will provide short-term and long-term effectiveness. ICs, which are described in Section 7.1.2 and include limitations on anchoring and digging in capped areas, warning signs, public education and periodic Site visits would be implemented at the Site.

The approximate limits of the sediment removal areas and the capping areas for this alternative are shown on Figure 8-3. Based on the remedial criteria, approximately 5,500 CY of contaminated sediment would be removed from the Site. Using the 5,500 CY volume estimate, it would take approximately 550 10-CY truck loads to transport all the contaminated material to an approved off-site landfill. These volume estimates assume the removal within specific areas and do not consider the additional volume from sloughing or from establishing the dredge slope factors. It was assumed that the dredge volumes would be revised during the design phase once an updated understanding of the dredge boundaries is established. Due to the larger removal footprint, the contours of the removal footprint, and the need for removal in the mouth of the Slough where deeper water will require a more robust work area isolation structure, it is likely that dredging “in the wet” would be the most appropriate approach to removal.

Evaluation of Alternative 2

Effectiveness

This alternative provides a moderate level of environmental protection and long-term effectiveness. This alternative meets the RAOs and ARARs immediately after the removal action construction phase by removing contaminated sediments that pose a risk to receptors (i.e., contaminated material in the BAZ). Sediment impacted by COCs beneath the BAZ would be isolated by an engineered cap or sediment that already meets RGs and RAOs prior to the removal action.
Risk of recontamination of surface sediment by impacted sediment left in place due to mechanisms, such as bioturbation and scour is low to moderate, although the cap design would address these mechanisms. However, because there is some uncertainty at this time if a 1-foot thick cap could effectively protect receptors in the long-term at Yosemite Slough, effectiveness was ultimately considered moderate.

During the removal action work at the Site, short-term impacts to receptors would be low due to the relatively moderate amount of sediment volume to be managed under this alternative compared to more intrusive, higher volume alternatives. In the short term, the impacts to human health and ecological receptors that could occur during construction would include potential exposure to contaminants through re-suspended sediment during dredging activities, the release of odors or fugitive dust emissions during sediment processing, and spillage during sediment processing, staging, or treatment, transportation and off-site disposal. These impacts could be mitigated by implementing BMPs, such as work area isolation during dredging, secondary containment for sediment processing facilities, and covering stockpiled sediment on the ground and in trucks.

Implementability

This alternative is implementable. The activities associated with this alternative are technically feasible using standard methods and procedures. The necessary equipment, personnel, and services are readily available to support implementation of this alternative. The components comprising Alternative 2 are commonly used remediation methods and can be implemented in a relatively short period of time. However, a more robust work area isolation structure likely would be required for the larger removal footprint associated with this alternative, particularly for dredging in the mouth of the Yosemite Slough where the water depths are greater.

This alternative is administratively feasible. According to 40 CFR § 300.415, on-site removal actions conducted under CERCLA are required to attain ARARs to the extent practicable. However, on-site removal actions are not required to comply with administrative requirements (requirements that facilitate the implementation of substantive requirements of a statute or regulation, such as permits). Compliance with applicable laws is required for the off-site disposal of contaminated material.

Cost

The estimated cost to implement this alternative is $11.0M for mechanical dredging “in the dry” and $10.3M for hydraulic dredging in 2013 dollars. The cost includes direct and indirect capital costs. Annual costs are also included in this alternative. The complete cost estimate for Alternative 2, including a list of assumptions, is provided in Appendix G.

8.2.3 Alternative 3 – Remove Sediment in the Top 1-foot Interval Where COCs Exceed Two Times the RGs, Engineered Cap, EMNR/MNR, and ICs

Alternative 3 consists of a combination of dredging, capping, EMNR/MNR and ICs. Under this alternative, sediment from 0- to 1-foot BSS that exceed twice the RGs would be removed. An engineered cap would be installed within the footprint of the resulting removal areas where deeper sediment exceeded RGs, and backfill would be placed in the remaining removal areas. EMNR/MNR would be implemented in areas where sediment from 0- to 1- foot BSS exceeds RGs. As a supplementary, optional component to this alternative, EMNR/MNR may be implemented as needed in portions of the Site where the BAZ is marginally above RGs as determined by the EPA. Use of EMNR/MNR will be subject to EPA pre-approval, based on EPA risk management principles, and only in locations where technical design evaluations indicate EMNR/MNR will provide short-term and long-term effectiveness. ICs, as described in Section 7.1.2 and include limitations on anchoring and digging in capped areas, warning signs, public education and periodic site visits would be implemented at the Site.

The progress and success of EMNR/MNR would be evaluated through periodic monitoring consisting of sediment sampling to verify if sediment concentrations are decreasing over time. These sampling events will be performed at three-year intervals until surface sediment concentrations are consistent with RAOs.

The layout of this alternative is shown on Figure 8-4. Based on the remedial criteria for this alternative, approximately 4,200 CY of contaminated sediment would be removed from the Site. Using the 4,200 CY volume estimate, it would take approximately 420 10-CY truck loads to transport all the contaminated material to an approved off-site landfill. This volume estimate assumes the removal within specific areas and does not consider the additional volume from sloughing or from establishing the dredge slope factors. It was assumed that the dredge volumes would be revised during the design phase once an updated understanding of the dredge boundaries is established. Due to the smaller removal footprint and the contours of the removal footprint associated with this alternative, it is likely that mechanical dredging “in the dry” would be the most appropriate approach to removal.

Evaluation of Alternative 3

Effectiveness

This alternative provides a low to moderate level of long-term environmental protection and effectiveness. RAOs and ARARs would not be met at the end of the removal action construction period. This alternative focuses on dredging only the higher risk surface sediments that exceed two times RGs and installing an engineered cap to isolate contaminated subsurface sediment from potential receptors. Remaining surface sediment left in place with COCs between 1 and 2 times RGs would be addressed through monitored natural recovery processes, which may reduce risk over time. However, as described in Section 7.1.3, there are several uncertainties concerning the actual nature of the natural recovery processes occurring at the Site and long-term effectiveness of those processes.

Construction-related short-term risk to ecological receptors would be low due to the small dredging footprint. However, human and ecological receptors would continue to be exposed to risks related to surface sediment one and two times RGs until natural recovery processes address those risks over time.

During the removal action work at the Site, the short-term impacts to human health and ecological receptors that could occur during construction would include potential exposure to contaminants through the release of odors or fugitive dust emissions during sediment processing, and spillage during sediment processing, staging, or treatment, transportation and off-site disposal. However, due to the relatively small amount of sediment volume to be managed under this alternative compared to more intrusive, higher volume alternatives, these short-term impacts would be low and easily be mitigated by implementing BMPs, such as work area isolation during dredging, secondary containment for sediment processing facilities, and covering stockpiled sediment on the ground and in trucks.

Implementability

This alternative is highly implementable. The activities associated with this alternative are technically feasible using standard methods and procedures. The necessary equipment, personnel, and services are readily available to support implementation of this alternative. The components comprising Alternative 3 are commonly used remediation methods and can be implemented in a relatively short period of time. Because the removal footprint associated with this alternative is small and located primarily in a portion of the Slough that is regularly exposed during low tide, a less robust work area isolation structure would be needed to complete sediment removal. Portable dams or similar structures make this alternative readily implementable.

This alternative is administratively feasible. According to 40 CFR § 300.415, on-site removal actions conducted under CERCLA are required to attain ARARs to the extent practicable. However, on-site removal actions are not required to comply with administrative requirements (requirements that facilitate the implementation of substantive requirements of a statute or regulation, such as permits). Compliance with applicable laws is required for the off-site disposal of contaminated material.

Cost

The estimated cost to implement this alternative is $10.1M for mechanical dredging “in the dry” or $10.1M for hydraulic dredging in 2013 dollars. The cost includes direct and indirect capital costs. Annual costs are also included in this alternative. The complete cost estimate for Alternative 3, including a list of assumptions, is provided in Appendix G.

8.2.4 Alternative 4 - Remove Sediment in the Top 1-foot Interval Where COCs Exceed Three Times RGs (with two exceptions); EMNR/MNR, Engineered Cap or Backfill, and ICs

Alternative 4 consists of a combination of dredging, capping, backfilling, EMNR/MNR, and ICs. Under this alternative, sediment from 0- to 1-foot BSS that exceed three times the RGs would be removed. Two exceptions to the delineation of sediment identified for removal include the areas associated with the YC-03 and YC-12 sampling locations, which exceed three times the RGs for at least one of the Site COCs, but have been deemed reasonable for EMNR/MNR technology evaluation. An engineered cap would be installed within the footprint of the resulting removal areas where deeper sediment exceeded three times the RGs, and backfill would be placed in the remaining removal areas. EMNRMNR would be implemented in areas where sediment from 0- to 1-foot BSS that exceed RGs were not removed. As a supplementary, optional component to this alternative, EMNR/MNR may be implemented as needed in portions of the Site where the BAZ is marginally above RGs as determined by the EPA. Use of EMNR/MNR will be subject to EPA pre-approval, based on EPA risk management principles, and only in locations where technical design evaluations indicate EMNR/MNR will provide short-term and long-term effectiveness. ICs, as described in Section 7.1.2 and include limitations on anchoring and digging in capped areas, warning signs, public education and periodic site visits would be implemented at the Site.

The progress of EMNR/MNR would be evaluated through periodic monitoring consisting of sediment sampling to verify that sediment concentrations are decreasing over time. These sampling events will be performed at three-year intervals until surface sediment concentrations are consistent with RAOs.

The layout of this alternative is shown on Figure 8-5. Based on the remedial criteria of this alternative, approximately 2,500 CY of contaminated sediment would be removed from Yosemite Slough. Using the 2,500 CY volume estimate, it would take approximately 250 10-CY truck loads to transport all the contaminated material to an approved off-site landfill. This volume estimate assumes the removal within specific areas and does not consider the additional volume from sloughing or from establishing the dredge slope factors. It was assumed that the dredge volumes would be revised during the design phase once an updated understanding of the dredge boundaries is established. Due to the smaller removal footprint and the contours of the removal footprint associated with this alternative, it is likely that mechanical dredging in the dry would be the most appropriate approach to removal.

Evaluation of Alternative 4

<u>**Effectiveness**</u>

This alternative provides a low level of long-term environmental protection and effectiveness. RAOs and ARARs would not be met immediately after the removal action construction phase. This alternative focuses on dredging only the highest risk surface sediments that exceed three times RGs (except for two locations described above) and installing an engineered cap to isolate contaminated subsurface sediment from potential receptors. Remaining surface sediment left in place with COCs between one and three times RGs would be addressed through monitored natural recovery processes, which would reduce risk over time. However, as described in Section 7.1.3, there are several uncertainties concerning the actual nature of the natural recovery processes occurring at the Site and long-term effectiveness of those processes.

Construction-related short-term risk to ecological receptors would be low due to the small dredging footprint. However, human and ecological receptors would continue to be exposed to risks related to surface sediment one and three times RGs until natural recovery processes address those risks over time. In the short term, the impacts to human health and ecological receptors that could occur during construction would include potential exposure to contaminants through the release of odors or fugitive dust emissions during sediment processing, and spillage during sediment processing, staging, or treatment, transportation and off-site disposal. However, due to the relatively small sediment volume to be managed under this alternative compared to more intrusive, higher volume alternatives, these impacts would be considered low and easily mitigated by implementing BMPs, such as work area isolation during dredging, secondary containment for sediment processing facilities, and covering stockpiled sediment on the ground and in trucks.

Implementability

This alternative is highly implementable. The activities associated with this alternative are technically feasible using standard methods and procedures. The necessary equipment, personnel, and services are readily available to support implementation of this alternative. The components comprising Alternative 4 are commonly used remediation methods and can be implemented in a relatively short period of time. Because the removal footprint associated with this alternative is small and primarily located in a portion of the Slough that is regularly exposed during low tide, a less robust work area isolation structure would be needed to complete sediment removal. Portable dams or similar structures make this alternative readily implementable.

This alternative is administratively feasible. According to 40 CFR § 300.415, on-site removal actions conducted under CERCLA are required to attain ARARs to the extent practicable. However, on-site removal actions are not required to comply with administrative requirements (requirements that facilitate the implementation of substantive requirements of a statute or regulation, such as permits). Compliance with applicable laws is required for the off-site disposal of contaminated material.

Cost

The estimated cost to implement this alternative is $8.6M for mechanical dredging in the dry or $8.8M for hydraulic dredging in 2013 dollars. The cost includes direct and indirect capital costs. Annual costs are also included in this alternative. The complete cost estimate for Alternative 4, including a list of assumptions, is provided in Appendix G.

8.2.5 Alternative 5 – Remove Sediment in the Top 1-foot Interval where COCs Exceed RGs, up to 2 feet where COCs Exceed RGs in both the 0 to 1-foot and 1- to 2-foot BSS Intervals, Engineered Cap, EMNR/MNR, and ICs

Alternative 5 consists of a combination of dredging, capping, and ICs. Under this alternative, sediment from 0 to 1 feet BSS that exceed RGs and sediment up to 2 feet BSS that exceed RGs in both the 0- to 1-foot BSS and 1 to 2 feet BSS would be removed. An engineered cap would be installed within the footprint of the removal areas. The total thickness of the sediment removed would be dependent upon the design factors of the engineered cap. As a supplementary, optional component to this alternative, EMNR/MNR may be implemented as needed in portions of the Site where the COC concentrations in the BAZ are marginally above RGs as determined by the EPA. Use of EMNR/MNR will be subject to EPA pre-approval, based on EPA risk management principles, and only in locations where technical design evaluations indicate EMNR/MNR will provide short-term and long-term effectiveness. ICs, which are described in Section 7.1.2 and include limitations on anchoring and digging in capped areas, warning signs, public education and periodic site visits would be implement at the Site.

The layout of this alternative is shown on Figure 8-6. Based on the remedial criteria for this alternative, approximately 9,900 CY of contaminated sediment would be removed from the Site. This quantity would be reduced if EMNR/MNR was applied in areas of the site where it was shown to be effective in reducing COC concentrations in the BAZ to below RGs. In addition, because Alternative 5 assumes a dredge volume deeper than the assumed protective engineered cap depth of 1 foot, cap thickness and associated dredge volumes under this alternative may be revised during the design phase once an updated understanding of the dredge boundaries, cap properties, Site hydrodynamics, and other design parameters are established and approved by EPA. Reductions of the cap thickness under Alternative 5 will be allowed by EPA only after evaluation of all pre-design studies and determination that all required Site RGs and RAOs can still be maintained with a high degree of effectiveness in the long-term. For purposes of evaluation of Alternative 5, a dredge volume of 9,900 CY will be assumed with the understanding that the final dredge volume may be reduced or increased during the design stage. Using the 9,900 CY volume estimate, it would take approximately 990 10 CY truck loads to transport all the contaminated material to an approved off-site landfill. This volume estimate assumes the removal within specific areas and does not consider the additional volume from sloughing or from establishing the dredge slope factors. It was assumed that the dredge volumes would be revised during the design phase once an updated understanding of the dredge boundaries is established. Due to the larger removal footprint, the contours of the removal footprint, and the need for removal in the mouth of the slough where deeper water will require a more robust work area isolation structure, it is likely that dredging in the wet would be the most appropriate approach to removal.

Evaluation of Alternative 5

Effectiveness

This alternative provides a high level of environmental protection and long-term effectiveness. This alternative meets the RAOs and ARARs immediately after completion of the removal action construction phase by removing contaminated material that pose a risk to receptors, (i.e., contaminated material in the biological active zone). Some sediment impacted by COCs would be left in place under the cap and under areas of the Site that already have clean sediment in the 0 to 1 foot horizon. This sediment would be isolated from potential receptors by placement of an engineered cap or clean, in situ sediment remaining in-place which already meets RGs and RAOs prior to the removal action. Because this alternative includes a potentially a thicker cap (i.e., up to 2 feet in some locations), the EPA has a greater confidence in this alternative to effectively protect receptors in the long-term at Yosemite Slough.

Short-term risk to receptors would be generally moderate. Construction-related short-term risk to ecological receptors would be moderate due to the moderate dredging footprint required by this alternative. In the short-term, the impacts to human health and ecological receptors that could occur during construction would include potential exposure to contaminants through re-suspended sediment during dredging activities, the release of odors during sediment processing, and spillage during sediment processing, staging, or treatment, transportation and off-site disposal. However, due to the moderate amount of sediment volume to be managed under this alternative compared to more intrusive, higher volume alternatives, these short-term impacts would be moderate and mitigated by BMPs, such as work area isolation during dredging, secondary containment for sediment processing facilities, and covering stockpiled sediment on the ground and in trucks.

Implementability

This alternative is implementable. The activities associated with this alternative are technically feasible using standard methods and procedures. The necessary equipment, personnel, and services are readily available to support implementation of this alternative. The components comprising Alternative 5 are commonly used remediation methods and can be implemented in a moderate period of time. However, a more robust work area isolation structure would likely be required for the larger removal footprint associated with this alternative, particularly for dredging in the mouth of the Yosemite Slough where the water depths are greater.

This alternative is administratively feasible. According to 40 CFR § 300.415, on-site removal actions conducted under CERCLA are required to attain ARARs to the extent practicable. However, on-site removal actions are not required to comply with administrative requirements (requirements that facilitate the implementation of substantive requirements of a statute or regulation, such as permits). Compliance with applicable laws is required for the off-site disposal of contaminated material.

Cost

The estimated cost to implement this alternative is $15.5M for mechanical dredging in the dry or $15.1M for hydraulic dredging in 2013 dollars. The cost includes direct and indirect capital costs. Annual costs are also included in this alternative. The complete cost estimate for Alternative 5, including a list of assumptions, is provided in Appendix G.

8.2.6 Alternative 6 – Removal of Sediment in Top 2-foot Interval Where COCs Exceed RGs, Engineered Cap or Backfill, EMNR/MNR and ICs

Alternative 6 consists of a combination of dredging, capping, backfilling and ICs. Removal activities under this alternative would be performed to a depth of up to 2 feet BSS in areas where the sediment concentrations exceed the RGs. An engineered cap would be installed within the footprint of the resulting removal areas where deeper sediment exceeded RGs, and backfill would be placed in the remaining removal areas. As a supplementary, optional component to this alternative, EMNR/MNR may be implemented as needed in portions of the Site where the BAZ is marginally above RGs as determined by the EPA. Use of EMNR/MNR will be subject to EPA pre-approval, based on EPA risk management principles, and only in locations where technical design evaluations indicate EMNR/MNR will provide short-term and long-term effectiveness. ICs, which are described in Section 7.1.2 and include limitations on anchoring and digging in capped areas, warning signs, public education, and periodic site visits would be implemented at the Site.

The layout of this alternative is shown on Figure 8-7. Based on the remedial criteria for this alternative, approximately 25,300 CY of contaminated sediment would be removed from the Site. Using the 25,300 CY volume estimate, it would take approximately 2,530 10-CY truck loads to transport all the contaminated material to an approved off-site landfill. Due to the larger removal footprint, the contours of the removal footprint, and the need for removal in the mouth of the slough where deeper water will require a more robust work area isolation structure, it is likely that dredging in the wet would be the most appropriate approach to removal.

Evaluation of Alternative 6

Effectiveness

This alternative provides a high level of environmental protection and long-term effectiveness. This alternative meets the RAOs and ARARs by removing contaminated material that pose a risk to receptors, (i.e., contaminated material in the biological active zone). Some sediment impacted by COCs would be left in place below 2 feet BSS. This contaminated sediment would be isolated from potential receptors by an engineered cap or sediment meeting RGs prior to the removal action.

Short-term risk to receptors would be moderate to high due to the large dredging footprint and volume. In the short term, the impacts to human health and ecological receptors that could occur during construction would include potential exposure to contaminants through re-suspended sediment during dredging activities, the release of odors or fugitive dust emissions during sediment processing, and spillage during sediment processing, staging, or treatment, transportation and disposal. However, due to the relatively large sediment volume to be managed under this alternative, these short-term impacts would be moderate to high. These impacts would require mitigation with BMPs, such as work area isolation during dredging, secondary containment for sediment processing facilities, and covering stockpiled sediment on the ground and in trucks. In addition to the short-term risk to ecological receptors, the larger removal footprint associated with this alternative would result in destruction of a mature BAZ in areas where surface sediment does not exceed the RGs. The destruction of the BAZ in these areas would result in a longer time to re-populate the BAZ in Yosemite Slough post-remedy compared to alternative with smaller removal footprints.

Implementability

This alternative is implementable. However, due to larger removal footprint, it is possible the more difficult subsurface challenges (i.e., unanticipated large debris) may be encountered. The activities associated with this alternative are technically feasible using standard methods and procedures. The necessary equipment, personnel, and services are readily available to support implementation of this alternative. The components comprising Alternative 6 are commonly used remediation methods and can be implemented in a relatively short period of time. However, a robust work area isolation structure would likely be required for the larger removal footprint associated with this alternative, particularly for removal in the mouth of the Slough. In addition, Alternative 6 results in a significant volume of dredged sediment to be handled, managed, and transported off-site.

This alternative is administratively feasible. According to 40 CFR § 300.415, on-site removal actions conducted under CERCLA are required to attain ARARs to the extent practicable. However, on-site removal actions are not required to comply with administrative requirements (requirements that facilitate the implementation of substantive requirements of a statute or regulation, such as permits). Compliance with applicable laws is required for the off-site disposal of contaminated material.

Cost

The estimated cost to implement this alternative is $29.2M for mechanical dredging in the dry or $28.5M for hydraulic dredging in 2013 dollars. The cost includes direct and indirect capital costs. Annual costs are also included in this alternative. The cost estimate for Alternative 6, including a list of assumptions, is provided in Appendix G.

8.2.7 Alternative 7 – Full Removal Where COCs Exceed RGs (up to 4 feet), Backfill

Alternative 7 consists of a combination of dredging and backfilling. Removal activities under this alternative would be performed up to a depth of 4 feet BSS where sediment concentrations exceed the RGs. Following the sediment removal, bathymetry within Yosemite Slough will be restored by backfilling to pre-removal surface elevations. Similar to capping, it is assumed that clean dredge material excavated from San Francisco Bay would be used as backfill material. Following backfill of the removal action areas, the areas would be restored.

The layout of this alternative is shown on Figure 8-8. Based on the remedial criteria for this alternative, approximately 40,900 CY of contaminated sediment would be removed from the Site. Using the 40,900 CY volume estimate, it would take approximately 4,090 10-CY truck loads to transport all the contaminated material to an approved off-site landfill. Due to the larger removal footprint, the contours of the removal footprint, and the need for removal in the mouth of the slough where deeper water will require a more robust work area isolation structure, it is likely that dredging in the wet would be the most appropriate approach to removal.

Evaluation of Alternative 7

<u>Effectiveness</u>

This alternative provides a high level of environmental protection and long-term effectiveness, as complete removal of the contaminated material (up to 4 feet below sediment surface) from the Yosemite Slough would be achieved. This alternative would meet the RAOs and ARARs immediately after completion of the removal action construction phase.

Short-term risk to receptors would be high due to the large dredging footprint and volume. Significant impacts during the construction period include potential exposure to contaminants through re-suspended sediment during dredging activities, the release of odors or fugitive dust emissions during sediment processing, and spillage during sediment processing, staging, or treatment, transportation, and off-site disposal. Due to the relatively large sediment volume to be managed under this alternative compared to lesser intrusive, smaller volume alternatives, these short-term impacts would be significant and difficult to consistently mitigate. These impacts would require intensive mitigation with BMPs, such as work area isolation during dredging, secondary containment for sediment processing facilities, and covering stockpiled sediment on the ground and in trucks. Due the longer construction period, air quality impacts and odors to the local community may be significant. In addition to the short-term risk to ecological receptors, the larger removal footprint associated with this alternative would result in destruction of a mature BAZ in areas where surface sediment does not exceed the RGs. The destruction of the BAZ in these areas would result in a longer period of time to re-populate the BAZ throughout Yosemite Slough post-remedy, as compared to alternatives with smaller dredging footprints specifically focused in areas where the BAZ is impaired due to impacts from COCs.

In addition, implementation of this alternative would have high short-term impacts to the local community. Impacts to the local community associated with this alternative are a result of the longer duration of sediment processing activities which would contribute to longer term community exposure to odor and noise. In addition, the local community would be impacted by the increase in truck traffic through the surrounding area required to transport a relatively high amount of contaminated material to an off-site landfill for disposal.

Implementability

This alternative would be difficult to implement. The activities associated with this alternative are technically feasible using standard methods and procedures. The necessary equipment, personnel, and services are readily available to support implementation of this alternative. The components comprising Alternative 7 are commonly used remediation methods and are readily available. However, a robust work area isolation structure would likely be required for the larger removal footprint associated with this alternative. The Geotechnical Investigation Report (ARCADIS 2012) identified a number of engineering concerns associated with constructing a steel sheet pile wall across the mouth of Yosemite Slough. In addition, due to the dredge depth for this alternative, the risk of encountering large debris and other buried obstructions increases. These engineering concerns would require additional analysis during the design phase to determine the most feasible approach for work area isolation. In addition, Alternative 7 results in the largest volume of dredged sediment to be handled, managed, and transported off-site.

This alternative is administratively feasible. According to 40 CFR § 300.415, on-site removal actions conducted under CERCLA are required to attain ARARs to the extent practicable. However, on-site removal actions are not required to comply with administrative requirements (requirements that facilitate the implementation of substantive requirements of a statute or regulation, such as permits). Compliance with applicable laws is required for the off-site disposal of contaminated material.

Cost

The estimated cost to implement this alternative is $43.5M for mechanical dredging in the dry or $46.2M for hydraulic dredging in 2013 dollars. The cost includes direct and indirect capital costs. Annual costs are also included in this alternative. The complete cost estimate for Alternative 7, including a list of assumptions, is provided in Appendix G.

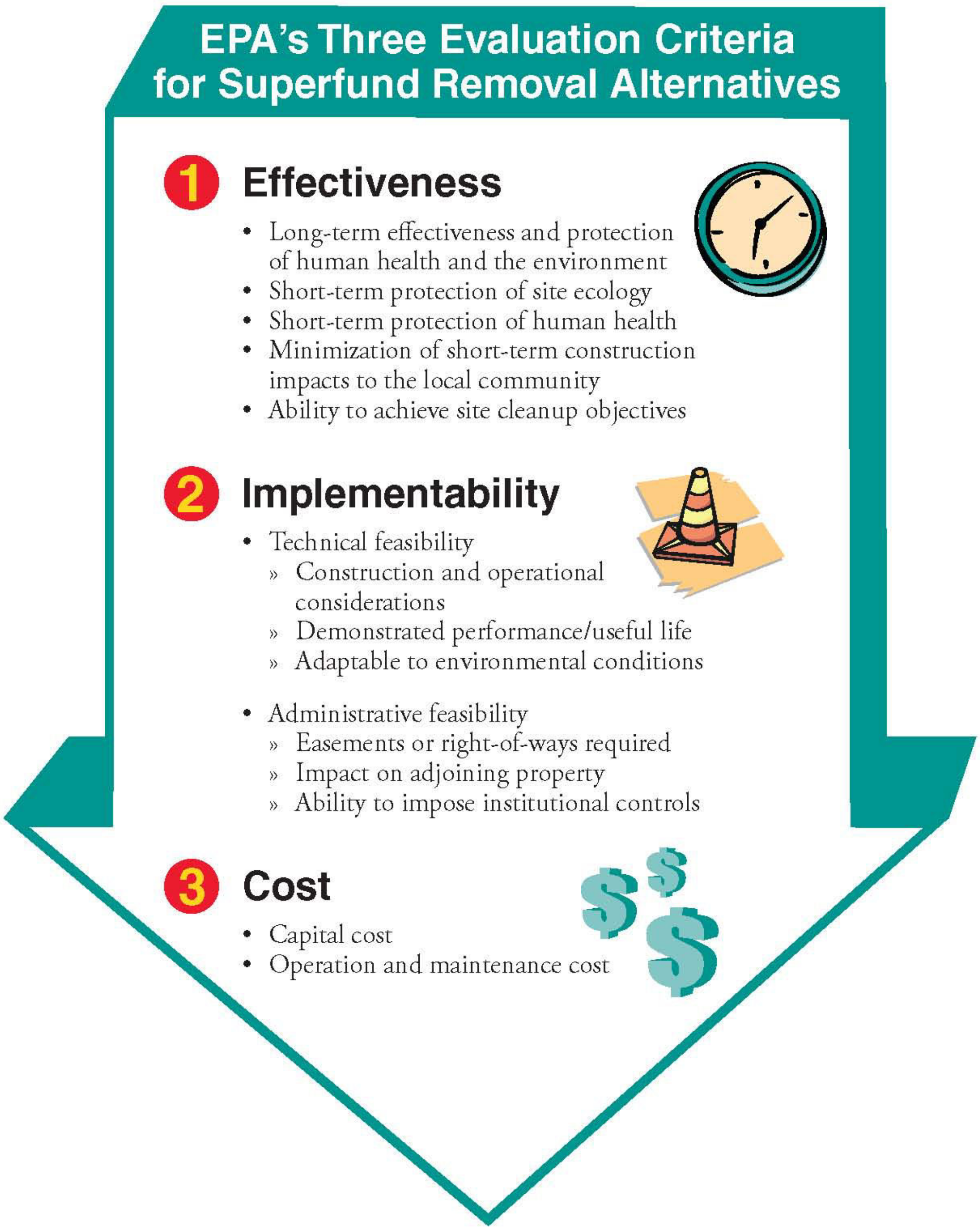


Figure 8-1. Evaluation Criteria for Removal Alternatives

Path: M:\Oakland\Yosemite_Creek\Maps\MXD\Report\2012_December\Potential_Staging_Areas.mxd Figure 8-1 Potential Staging Areas

Source: NAIP 2012.

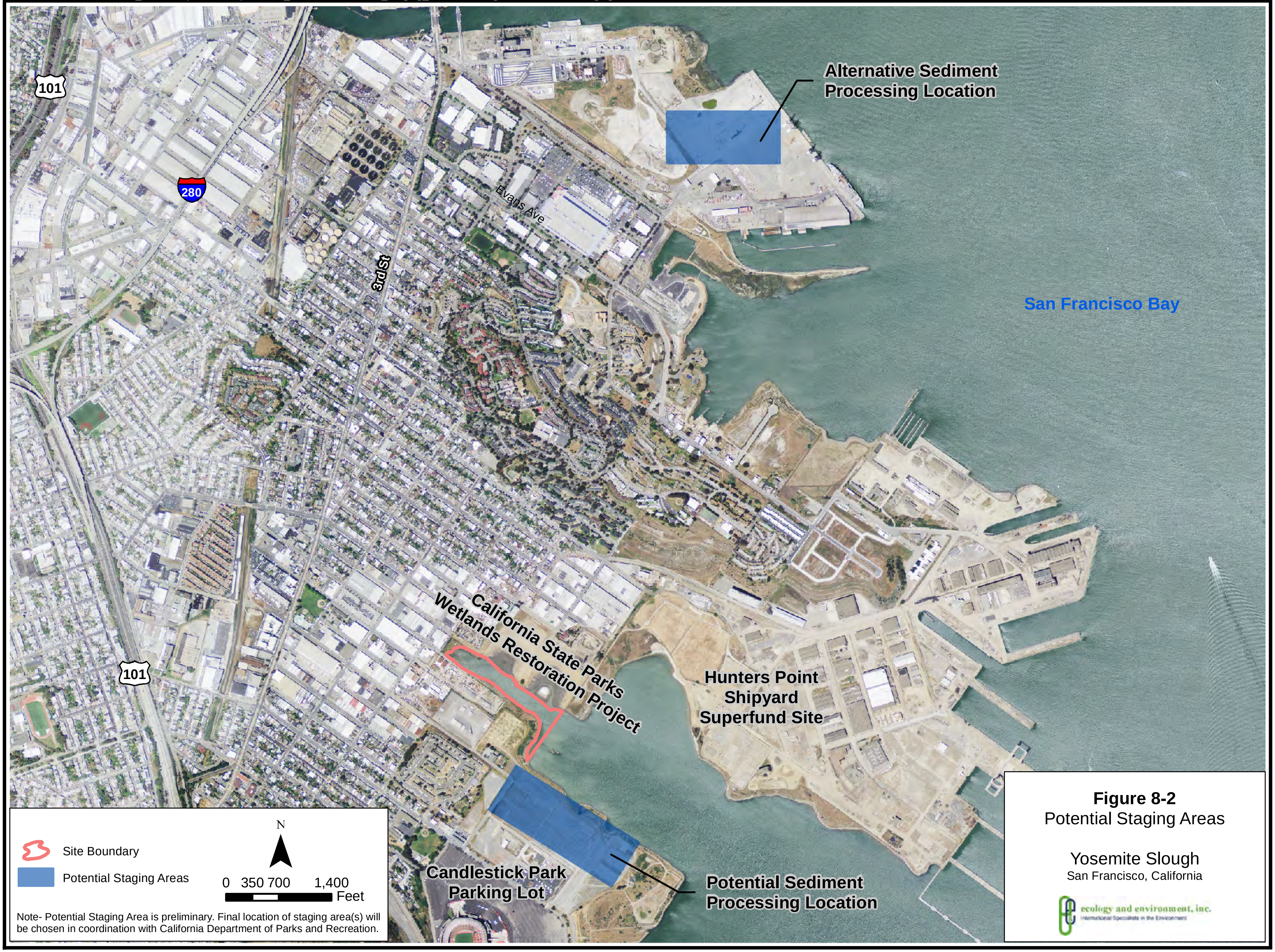
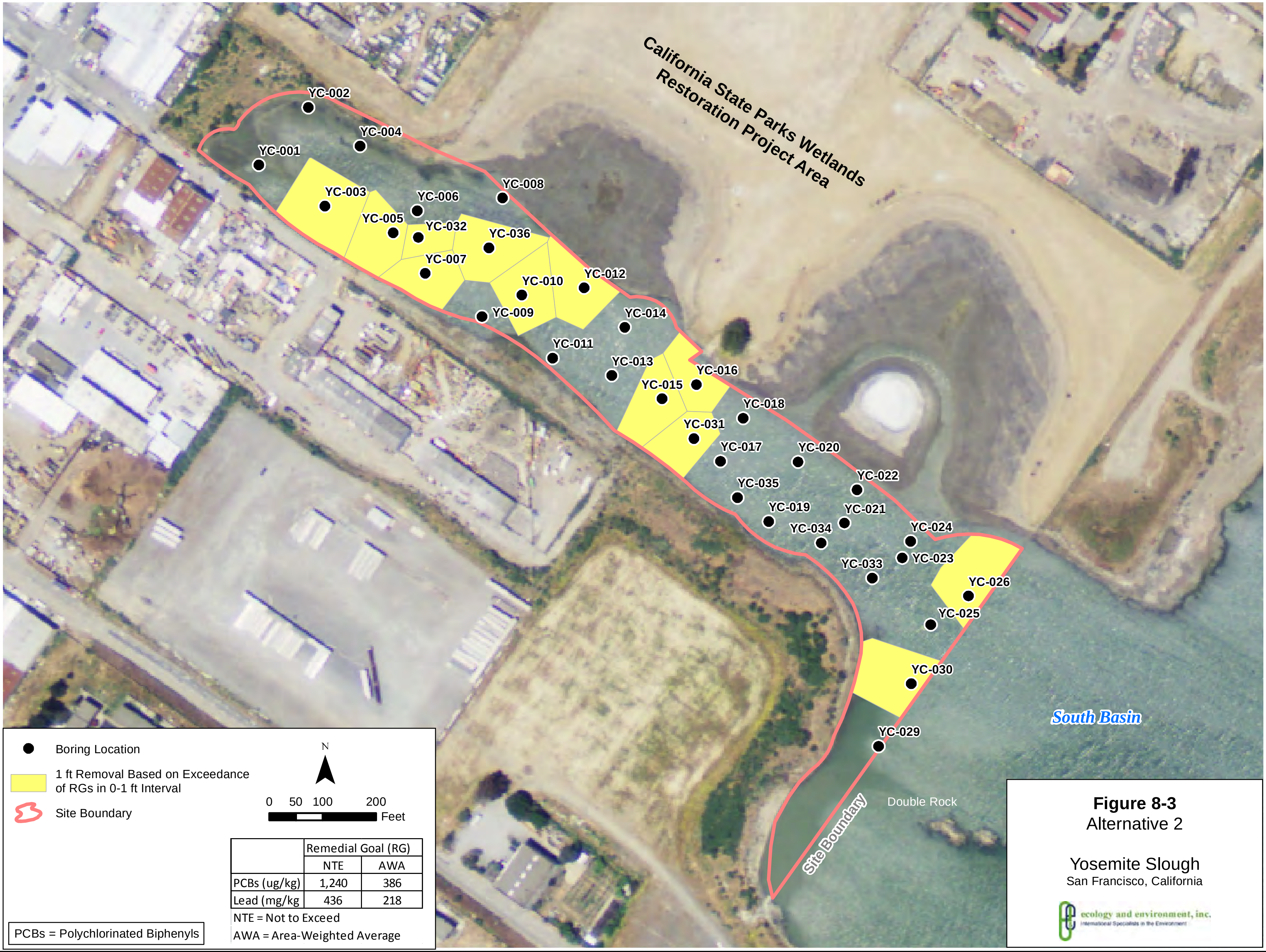


Figure 8-2
Potential Staging Areas

Yosemite Slough
San Francisco, California

Path: M:\Oakland\Yosemite_Creek\Maps\MXD\Report\2012_December\Alt_2.mxd Figure 8-2_Alternative 2

Source: NAIP 2012.



	Remedial Goal (RG)	
	NTE	AWA
PCBs (ug/kg)	1,240	386
Lead (mg/kg)	436	218

NTE = Not to Exceed
AWA = Area-Weighted Average

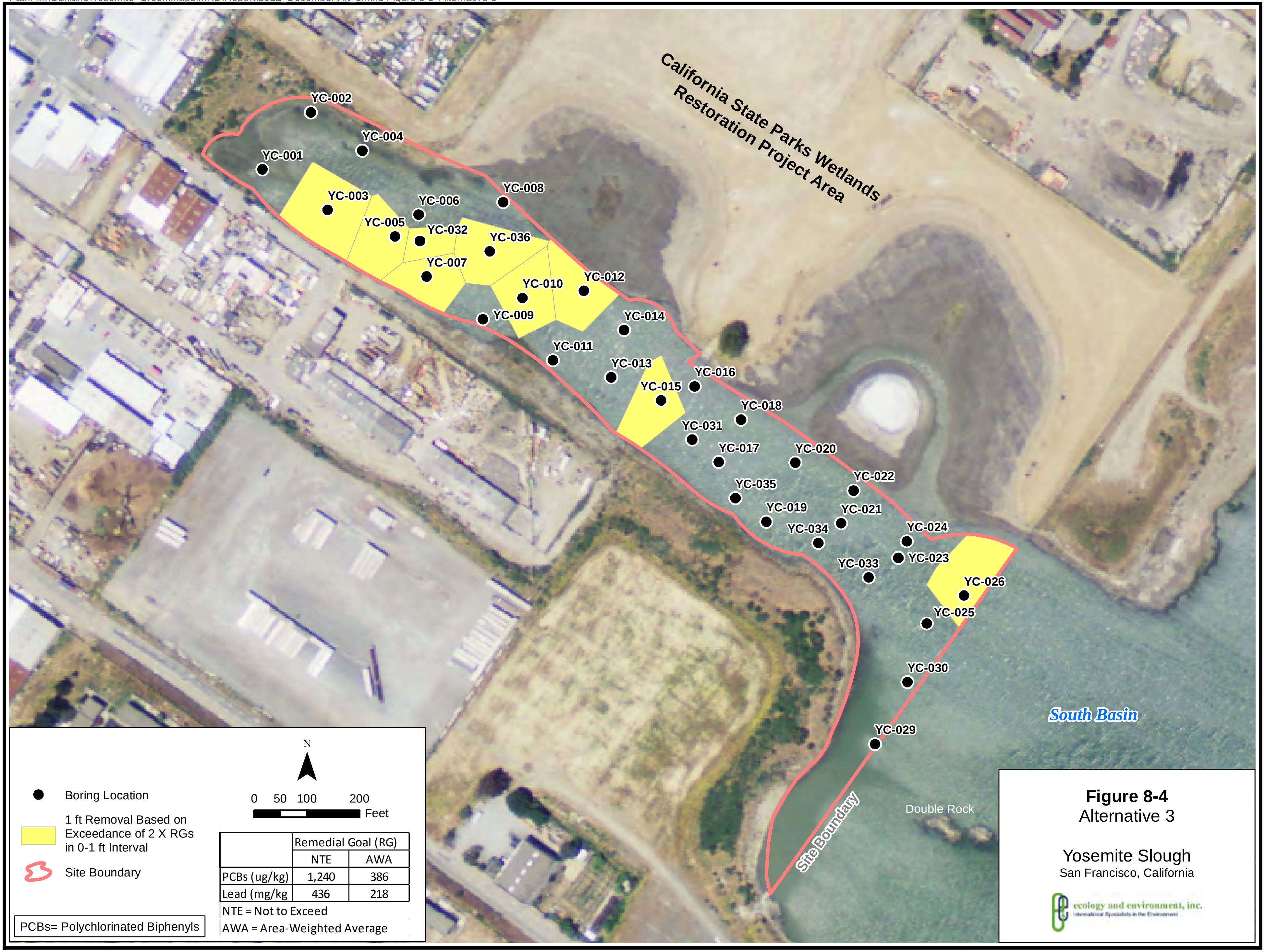
Figure 8-3
Alternative 2

Yosemite Slough
San Francisco, California

ecology and environment, inc.
International Specialists in the Environment

Path: M:\Oakland\Yosemite_Creek\Maps\MXD\Report\2012_December\Alt_3.mxd Figure 8-3_Alternative 3

Source: NAIP 2012.



	Remedial Goal (RG)	
	NTE	AWA
PCBs (ug/kg)	1,240	386
Lead (mg/kg	436	218

NTE = Not to Exceed
AWA = Area-Weighted Average

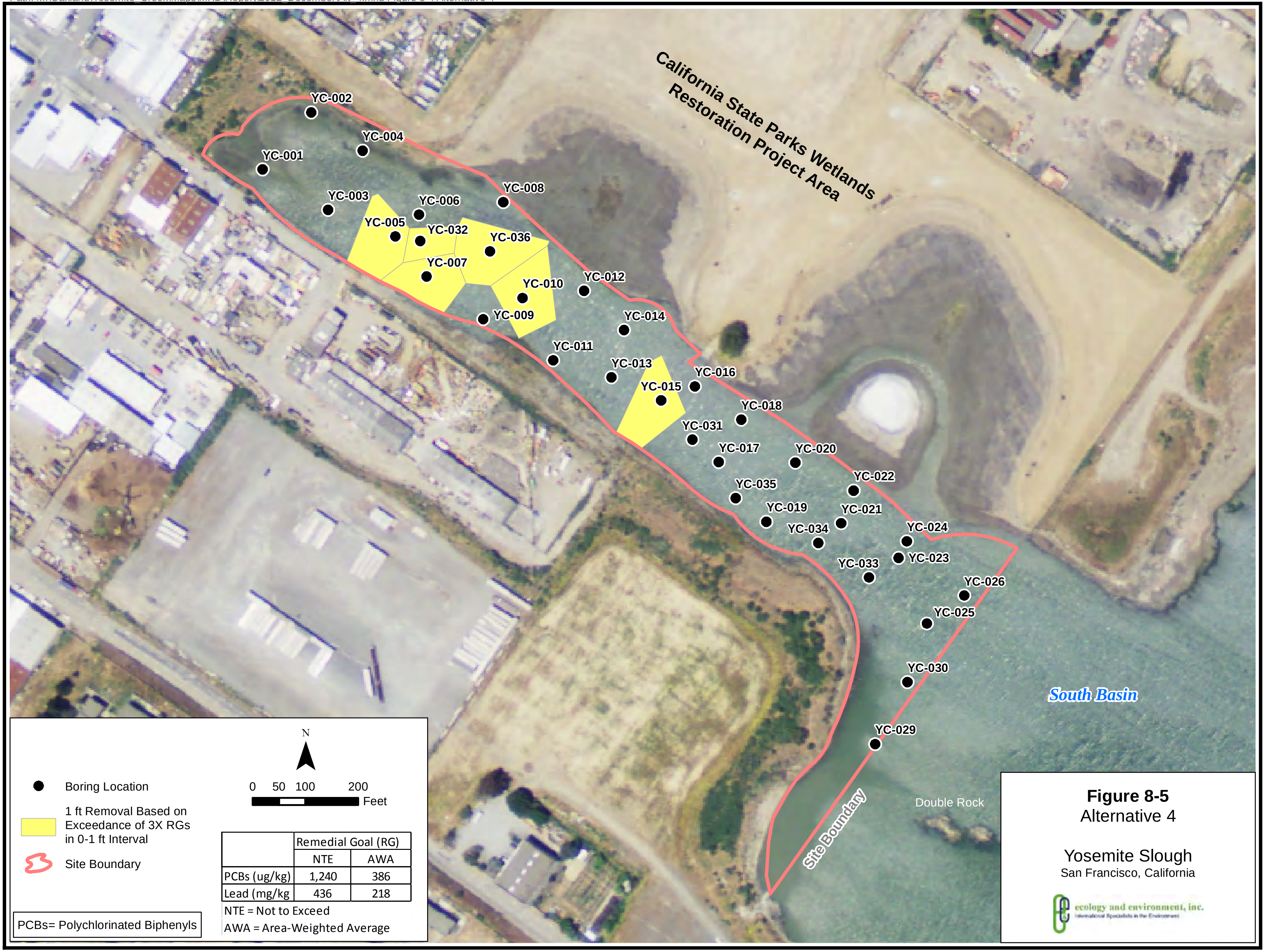
Figure 8-4
Alternative 3

Yosemite Slough
San Francisco, California

ecology and environment, inc.
International Specialists in the Environment

Path: M:\Oakland\Yosemite_Creek\Maps\MXD\Report\2012_December\Alt_4.mxd Figure 8-4 Alternative 4

Source: NAIP 2012.



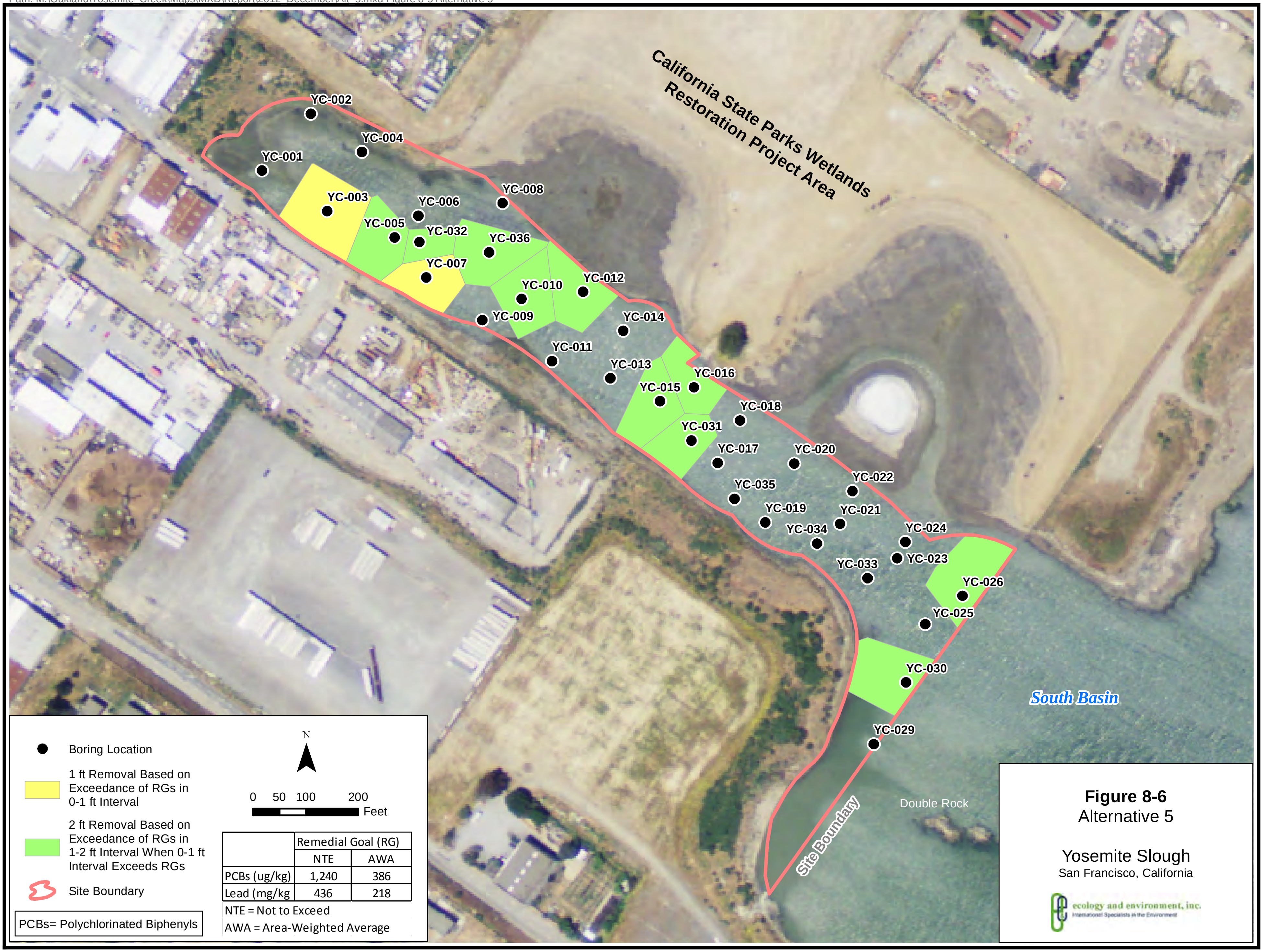
	Remedial Goal (RG)	
	NTE	AWA
PCBs (ug/kg)	1,240	386
Lead (mg/kg	436	218

Figure 8-5
Alternative 4

Yosemite Slough
San Francisco, California

Path: M:\Oakland\Yosemite_Creek\Maps\MXD\Report\2012_December\Alt_5.mxd Figure 8-5 Alternative 5

Source: NAIP 2012.



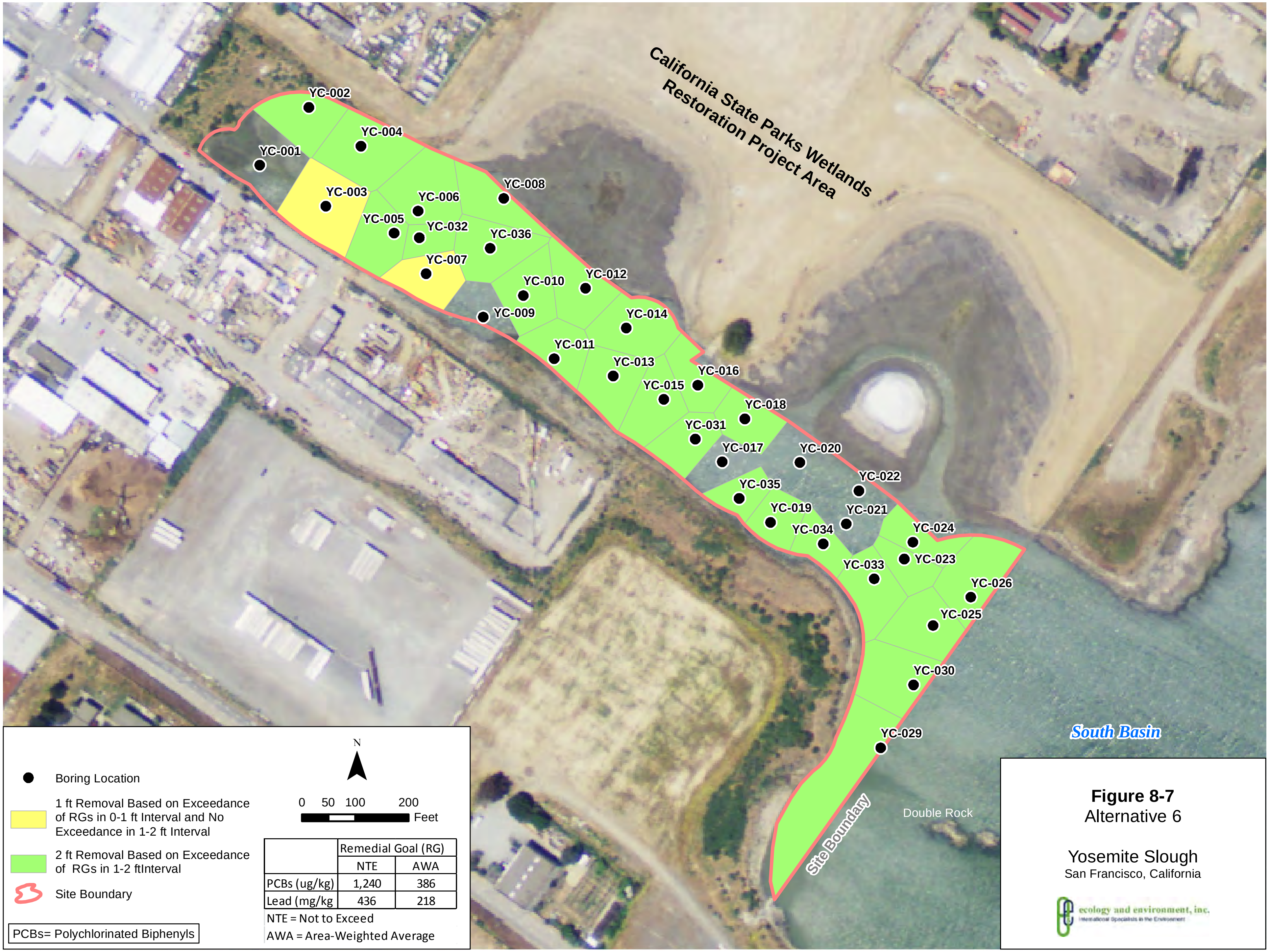
	Remedial Goal (RG)	
	NTE	AWA
PCBs (ug/kg)	1,240	386
Lead (mg/kg	436	218

Figure 8-6
Alternative 5

Yosemite Slough
San Francisco, California

Path: M:\Oakland\Yosemite_Creek\Maps\MXD\Report\2012_December\Alt_6.mxd Figure 8-6_Alternative 6

Source: NAIP 2012.



	Remedial Goal (RG)	
	NTE	AWA
PCBs (ug/kg)	1,240	386
Lead (mg/kg	436	218

NTE = Not to Exceed

AWA = Area-Weighted Average

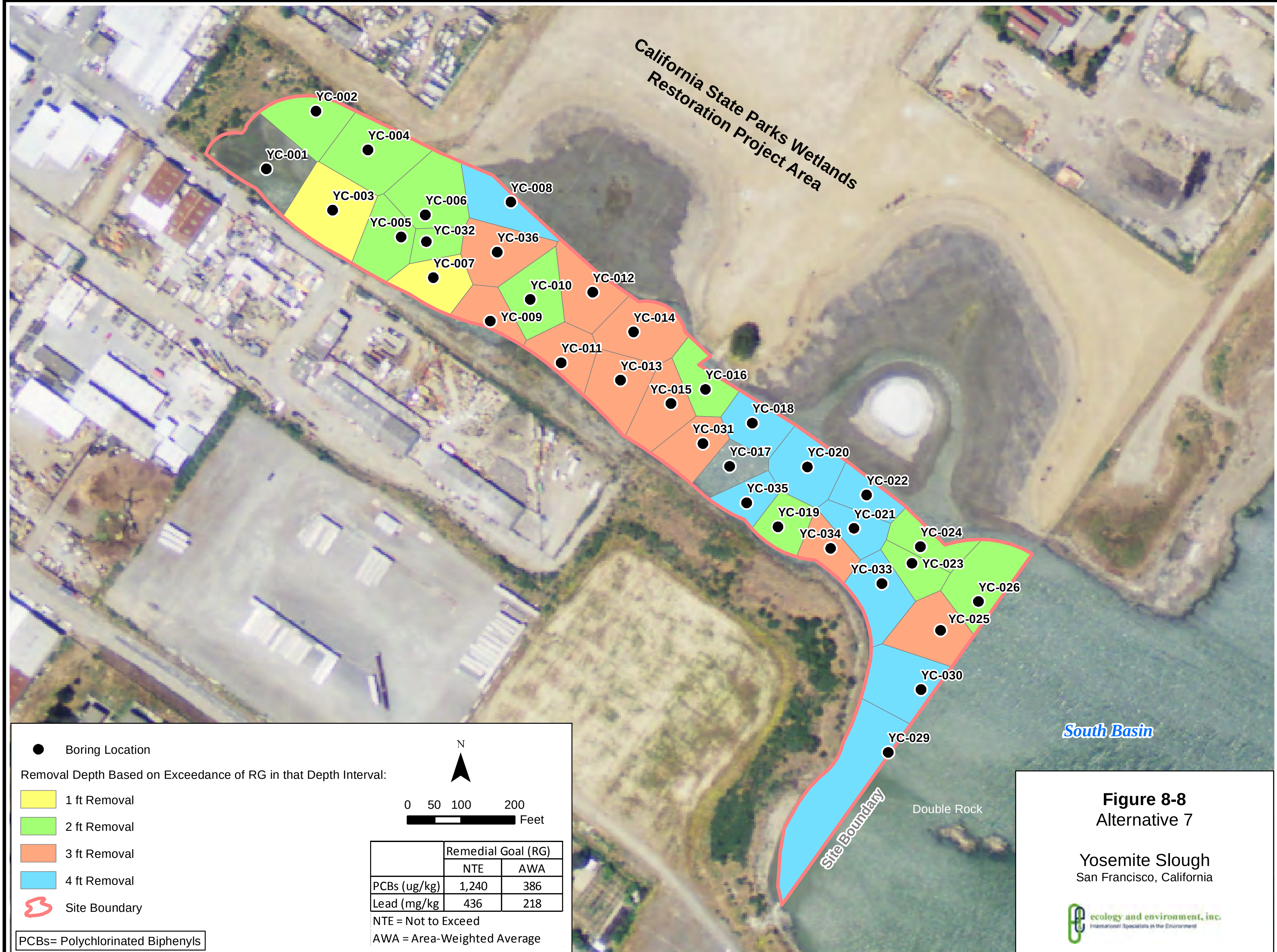
Figure 8-7
Alternative 6

Yosemite Slough
San Francisco, California

ecology and environment, inc.
International Specialists in the Environment

Path: M:\Oakland\Yosemite_Creek\Maps\MXD\Report\2012_December\Alt_7.mxd Figure 8-7 Alternative 7

Source: NAIP 2012.



	Remedial Goal (RG)	
	NTE	AWA
PCBs (ug/kg)	1,240	386
Lead (mg/kg	436	218

NTE = Not to Exceed

AWA = Area-Weighted Average

Figure 8-8
Alternative 7

Yosemite Slough
San Francisco, California

9 Comparative Analysis of Removal Action Alternatives

9.1 Comparative Analysis of Removal Action Alternatives

A comparative alternative analysis of the removal action alternatives with respect to the effectiveness, implementability, and cost criteria is presented in this section. This information is also summarized in Table 9-1.

Alternative 1 (the No Action Alternative) was deemed not effective in reducing the potential short-term or long-term risks to human health and the environment. Alternative 1 would not meet the RAOs and would not be compliant with ARARs. Therefore, Alternative 1 was not screened or evaluated.

Effectiveness

Long-Term Effectiveness. Alternatives 5, 6, and 7 provide a high degree of long-term effectiveness because RAOs are achieved with a high level of certainty of long-term permanence (assuming a cap or cover material of at least 2 feet in thickness is necessary and adequate). Alternative 2, because of uncertainties associated with whether an engineered cap of 1-foot thickness will be sufficient, is assumed to provide moderate long-term effectiveness. These uncertainties would be resolved or reduced during site-specific design studies and a detailed analysis of appropriate minimum cap thickness at the Site. Alternative 3 also provides moderate long-term effectiveness for the same reasons as Alternative 2 if it is assumed that EMNR/MNR would be a sufficiently effective remedy for portions of the Site that exceed two times the RGs. Alternative 4 provides low long-term effectiveness due to the unlikelihood that Site EMNR/MNR rates could reliably provide protection of receptors in areas currently at three or more times the RGs. Additional site-specific data and evidence would be necessary to show with sufficient confidence that unacceptable risk will be eliminated within a reasonable timeframe using EMNR/MNR as a key component of the remedy. Currently, that data is not available.

Short-Term Effectiveness. Due to the nature of sediment site remediation (e.g., working underwater or in a tidal environment, potential to resuspend and spread contamination, and odor concerns), short-term effectiveness was broken into three subcategories as shown in Table 9-1. Alternative 2 was deemed to have superior short-term effectiveness compared to the other alternatives. Alternative 2 provides protection to Site receptors immediately upon completion of remedy construction, and a smaller volume of contaminated sediment is managed, which minimizes the risk of inadvertent contaminant spreading and keeps traffic, noise, and odors impacts to the local community at a minimum. Although Alternatives 3 and 4 provide minimal construction-related impacts to the local community, these alternatives provide relatively low short-term protection to Site ecology and human health because, based on currently available data, risks to site contamination would continue to remain in the short-term due to reliance on EMNR/MNR. In comparison to Alternatives 6 and 7, Alternative 5 provides generally high short-term protection to Site receptors due to the relatively smaller volume of contaminated sediment managed during construction work, but odor and traffic impacts to the community were considered moderate in comparison to the Alternatives 2, 3, and 4. Alternatives 6 and 7 were considered to have low short-term effectiveness as the large volume managed under these alternatives creates a high potential for inadvertent resuspension and spreading of contaminants and a higher potential and longer timeframe for odor, noise, and traffic concerns to negatively impact the local community.

Implementability

Alternatives 2 through 7 are implementable as the included technologies are readily available and experienced contractors are available within the local San Francisco area. However, recommended sediment removal methodology for these alternatives varies depending on the size of sediment removal footprint.

Larger removal footprints required under Alternatives 6 and 7 would require much more robust work area isolation structures, some of which may not be readily feasible due to the water depths at the mouth of the Slough, and the subsurface conditions, such as shallow bedrock, and physical obstructions in the Slough. In addition, the large removal volumes under Alternative 7 would require longer construction durations and potentially larger sediment processing and operation of water treatment facilities. Therefore, Alternative 7 ranks the lowest in terms of technical implementability.

All alternatives are administratively implementable.

Cost

Alternative 4 has the lowest total capital cost and Alternative 7 has the highest capital cost. Alternative costs are summarized in Table 9-1 and detailed cost estimates are provided in Appendix G.

9.2 Summary of the Selected Removal Action Alternative

9.2.1 The Selected Alternative

The selected removal action is Alternative 5. Alternative 5 is described in Section 8.2.5 and includes all the common removal action components described in Section 8.1.

Table 9-1 Comparative Analysis of Removal Action Alternatives

		Post-Removal AWAs		Effectiveness				Implementability		Cost		
Alternative Number	Estimated Sediment Volume Removed (1)	Lead (mg/kg) RG: 218	PCBs (ug/kg) RG: 386	Long-Term Effectiveness and Protection of Human Health	Short-Term Protection of Site Ecology	Short Term Protection of Human Health	Minimization of Short Term Construction Impacts to the Local Community	Technical	Administrative (Y/N)	Mechanical Dredging	Hydraulic Dredging	Overall Score
1	-	359	5049	N/A	Not screened further					$0	$0	-------
2	5,500	128	327	Moderate	High	High	High	High	Y	$10,981,000	$10,346,000	High
3	4,200	143	499	Moderate	Moderate	Moderate	High	High	Y	$10,132,000	$10,126,000	Moderate
4	2,500	259	793	Low	Low	Low	High	High	Y	$8,586,000	$8,806,000	Low
5	9,900	128	327	High	High	High	Moderate	High	Y	$15,478,000	$15,132,000	High
6	25,300	49	35	High	Moderate	Moderate	Low	High	Y	$29,227,000	$28,476,000	Moderate
7	40,900	42	27	High	Low	Low	Low	Moderate	Y	$43,454,000	$46,212,000	Low

(1) Alternatives 5 and 6 assume a dredge volume deeper than the assumed protective engineered cap depth of 1 foot. Therefore, cap thickness and associated dredge volumes under thes alternatives may be revised during the design phase once an updated understanding of the dredge boundaries, cap properties, Site hydrodynamics, and other design parameters are established and approved by EPA.

9.2.2 Rationale for the Recommended Alternative

As presented in Table 9-1, Alternatives 2 and 5 obtain the best overall ranks compared to the other alternatives. The EPA recommends the selection of Alternative 5 due to its potential to provide more certainty with respect to long-term effectiveness compared to Alternative 2. However, these alternatives are similar, varying mostly in the assumed thickness of engineered cap. As described in Section 8.2.5, Alternative 5 assumes a deeper dredge depth than the assumed protective engineered cap thickness of 1 foot in Alternative 2. Thus, cap thickness and associated dredge volumes under Alternative 5 may be revised during the design phase once an updated understanding of the dredge boundaries, cap properties, site hydrodynamics, and other design parameters are established and approved by the EPA. Reductions of the cap thickness under Alternative 5 will be considered by the EPA after evaluating pre-design studies and determining that required Site RGs and RAOs can be attained and maintained with a high degree of certainty for long-term effectiveness.

The advantage of designing an engineered cap that can provide a high degree of long-term effectiveness but minimal cap thickness is that such a cap would involve improved short-term effectiveness (similar to Alternative 2) due to a lesser dredge volume to manage, treat, and transport off site. So while at this time it is assumed that Alternative 5 includes a dredge volume of 9,900 CY, the final dredge volume may be reduced or increased during the design stage.

Of the seven alternatives, Alternative 5 offers the best opportunity to achieve RAOs and RGs in a timely, efficient, and permanent fashion while minimizing short-term impacts to the Site ecology and local community. Alternative 5 also offers options, which can be explored during the design phase, to apply appropriate application of risk management principles, subject to EPA approval, including optimization of the thickness of the engineered cap and the use of EMNR/MNR where deemed effective. For these reasons, EPA considers Alternative 5 to be the most appropriate alternative for implementation.

9.3 Design Studies Required to Finalize the Recommended Removal Alternative

Design studies required during the development of the design report for Alternative 5, include but are not limited to:

- Physical and chemical characteristics of sediment resuspension;
- Engineered cap design details;
- Groundwater quality and flow;
- Backfill and cap material assessment and testing;
- Site-specific evaluation of BAZ to support cap design;
- Hydrodynamic study and potential cap scouring effects;
- Sediment odor generation potential;
- EMNR/MNR evaluation;
- Remediation effectiveness evaluation;
- Wastewater treatment system design details;

- Sediment dewatering system design details;
- Lead in sediment pre-treatment alternatives and disposal design details;
- Upland source control planning;
- Geotechnical evaluation of sediment and wastewater treatment areas; and
- CSO flow quality and flow rate study to evaluate the need for CSO modifications to ensure the response action protectiveness.

In addition to the design studies listed above, various surveys, work plans, and implementation plans (including but not limited to site surveys, air/dust/community monitoring plans, traffic management plans, soil management plans, response action effectiveness monitoring plan) will be required.

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A

Supplemental Ecological Risk Evaluation for Protection of Threatened and Endangered Species

A1 California Clapper Rail

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TECHNICAL MEMORANDUM

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Date:
September 12, 2012

ARCADIS Project No.:
B0002251.0001.00015

Subject:
Derivation of Preliminary Risk-Based Concentrations for the California Clapper Rail for PCBs – Yosemite Slough

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This technical memorandum, prepared by ARCADIS, presents the rationale and back-calculation of risk-based concentrations (RBCs) for polychlorinated biphenyls (PCBs) applicable to sediment at Yosemite Slough (the Site) for the protection of California clapper rail (CCR; *Rallus longirostris obsoletus*). CCR are not currently found at the Site. However, due to the California State Parks restoration effort around the slough, it has been suggested that suitable foraging and nesting habitat for the CCR may be created. As such, site-specific RBCs for PCBs protective of CCRs were derived in this memorandum to assess whether current cleanup goals will also be protective of CCR.

Background

Remediation goals for PCBs were provided in the Hunters Point Shipyard (HPS) Parcel F Feasibiliity Study (Barajas & Associates, Inc. 2008) based on site-specific studies provided in the *Final HPS Parcel F Validation Study* (Battelle, BBL, and Neptune & Co. 2005) and other considerations. The proposed remediation goals for Parcel F include:

- A not-to-exceed value of 1.24 mg/kg, based on the protection of the surf scoter using a site use factor (SUF[1]) of 0.5; and

- An area-weighted average (AWA) of 0.386 mg/kg, which was simply the calculated, theoretical post-remedial AWA following removal of all sediments with over 1.24 mg/kg of PCBs within Parcel F. This value is not ecologically based but rather corresponds to a post-remedial excess lifetime cancer risk of 3E-06) for human health receptors.

The approach used to calculate the remedial goals at HPS described above is somewhat unusual. More typically, ecological remedial goals based on foraging species such as the surf scoter will be calculated and applied as an AWA since these types of receptors are exposed across their foraging areas and not on a point-by-point basis. At HPS, the approach used for calculating risk for the surf scoter as a NTE level assumes exposure on a point-by-point basis and is thus more conservative than calculating risk based on an AWA. As noted above, the AWA value calculated for HPS is not an ecologically-based value, but a post-remedial concentration based on human health risk.

The remediation goals from HPS listed above have been adopted at Yosemite Slough. This memorandum calculates RBCs for the CCR and compares those to the remediation goals listed above to assess the protectiveness of these goals.

California Clapper Rail

The CCR is listed as endangered under both the State of California and Federal Endangered Species Acts (LSA Associates, Inc. 2009). In saline emergent wetlands, CCRs nest mostly in lower zones near tidal sloughs and where cordgrass (*Spartina foliosa*) is abundant. They prefer tall stands of pickleweed (*Salicornia virginica*) and Pacific cordgrass but are also associated with gumplant (*Grindelia* spp.), saltgrass (*Distichlis spicata*), alkali heath (*Frankenia grandifolia*), and jaumea (*Jaumea carnosa*) in high marshes. CCR prefers habitats containing marshes supporting tidal sloughs that provide direct tidal circulation throughout the area. They also require shallow water and mudflats with sparse vegetation and abundant invertebrate populations for foraging habitat, and escape routes from predators (Zembal and Massey 1983, Foerster *et al.* 1990, as cited by LSA Associates, Inc. 2009). Thus, future habitat in restored areas around and within some portions of Yosemite Slough may provide habitat for the endangered CCR.

[1] The site use factor (SUF) is an estimate of the amount of time the receptor is expected to utilize the site. The SUF should consider exposure parameters such as the receptor's home range, foraging range, size of the site, and/or possibility of migration. Available habitat for the receptor should also be considered.

RBC Calculation

To evaluate whether post-remedial exposure concentrations of PCBs in associated mudflats would be protective of CCR, RBCs were calculated by re-arranging the standard U.S. Environmental Protection Agency (USEPA 1997) risk model to solve for no-effect and lowest-effect target hazard quotients (HQs) of 1, which are considered to be protective of ecological receptors including the CCR. The model used to solve for RBCs is as follows:

$$HQ = \frac{Dose}{TRV}$$

Where:

$$Dose = \frac{\{C_{sed} \times IR_{sed} \times [IR_{food} \times [(BAF_{invert} \times \%diet) + (BAF_{plant} \times \%diet)]\} \times SUF}{BW}$$

The equation is rearranged to solve for C_{sed}, such that:

$$RBC = C_{sed} = \frac{TRV \times BW \times HQ}{SUF \times \{IR_{sed} + [IR_{food} \times [(BAF_{invert} \times \%diet) + (BAF_{plant} \times \%\ diet)]]\}}$$

Where:

RBC	=	risk-based concentration
C_{sed}	=	concentration in sediment (milligrams per kilogram)
SUF	=	site use factor (unitless)
TRV	=	toxicity reference value (milligrams per kilogram of body weight per day)
BW	=	body weight (kilograms)
IR_{sed}	=	ingestion rate of sediment (kilograms per day, dry weight)
IR_{food}	=	ingestion rate of food (kilograms per day, dry weight)
BAF_{invert}	=	sediment-to-invertebrate bioaccumulation factor in dry weight (unitless)
BAF_{plant}	=	sediment-to-plant bioaccumulation factor in dry weight (unitless)
% diet	=	percent of receptor's diet
HQ	=	hazard quotient; set to 1 to back-calculate the RBC

Exposure factors for CCR, used as inputs to the above equation, were obtained from California's Office of Environmental Health Hazard Assessment (OEHHA) and Department of Toxic Substances Control (DTSC), as appropriate. Supplemental values for food ingestion were calculated based on allometric ingestion rate equations presented by Nagy (2001). Sediment ingestion rates were estimated on a dry weight basis, using the least sandpiper as a surrogate for the CCR, which has similar foraging habits, obtained from Beyer et al. (1994). Exposure factors and their derivation/basis are provided in Table 1.

CCR forage in higher marsh vegetation, along the vegetation and mudflat interface, and along tidal creeks. They feed by gleaning, pecking, probing, and scavenging from the surface (Harvey 1990). Along the coast, CCR prey on crabs, mussels, clams, snails, insects, spiders, and worms (Harvey 1990). In a study by Moffitt (1941), the volumetric content of CCR stomachs averaged more than 85 percent (%) animal matter and 14.5% vegetable matter. Therefore, for the RBC calculations, the CCR's diet was assumed to consist of 85% invertebrates and 15% plants.

To estimate the potential concentration of PCBs in food items, bioaccumulation factors (BAFs) were incorporated into the above equation. BAFs were multiplied by the sediment concentration to provide an estimate of predicted tissue concentration. The sediment-to-invertebrate BAF for PCBs was based on the BAF calculated for the South Basin (Area X) of Hunters Point Shipyard (HPS) from the *Final HPS Parcel F Validation Study* (Battelle, BBL, and Neptune & Co. 2005). For that study, laboratory-exposed *Macoma nasuta* tissue and sediment PCB concentrations from the study area were evaluated to develop a ratio representative of the potential uptake of PCBs into *M. nasuta* tissue. That BAF value of 2 was utilized in the development of remedial goals for the HPS site (Barajas & Associates, Inc. 2008). Due to the similarity and proximity of the Site, a BAF_{invert} value of 2 was also selected for the RBC calculation for the CCR.

The sediment-to-plant BAF was developed based on the regression equation presented in Travis and Arms (1988) for the estimation of uptake of organic constituents into vegetation:

$$\text{Log } BAF_{vegetation} = 1.588 - 0.578 \log K_{ow}$$

The Travis and Arms model utilizes the log value of each constituent's bioaccumulation potential (i.e., the octanol-water partition coefficient [K_{ow}]) to predict uptake. BAF_{plant} was developed using log K_{ow} for seven individual Aroclors, and the average BAF (0.033) for all Aroclors was selected for the RBC calculation for the CCR.

For the SUF, the area of potentially exposed mudflat and future available habitat along the perimeter of the slough was estimated to be approximately 10 acres. This is based on estimated measurements of the area of the slough, which equal approximately 10 acres. This value was divided by the clapper rail's home range, which is approximately 31 acres, based on mean available data for clapper rails in Arizona (Conway et al. 1993). Thus, a SUF of 0.3 is considered to be a relatively conservative value for the mudflat/exposed area of the slough and given that wetland habitats planned to be created on State Parks land will likely be higher quality and more suitable foraging habitat. To provide a range of potential RBCs utilizing a range of SUFs to bound this value, RBCs were calculated for SUFs ranging from 0.01 to 1 (Tables 2 and 3).

Toxicity reference values (TRVs) are literature-based values of concentrations of chemicals that have known toxicological effects on an organism. They can be based on no observed adverse effects level (NOAEL) or lowest observed adverse effects level (LOAEL). TRVs were selected for birds from the

USEPA's Region 9 Biological Technical Assistance Group (BTAG) (DTSC 2009). Sample and Arenal (1999) recommend scaling the TRV based on the target receptor's body weight. This was done at the HPS site for the Validation Study (Battelle, BBL, and Neptune & Co. 2005), although DTSC does not currently recommend incorporating allometric scaling of TRVs for receptors that differ in body weight from the test species by less than two orders of magnitude (DTSC 1999) and USEPA generally does not recommend scaling of TRVs.

An automated, iterative calculation algorithm was used to combine the dose equation and uptake factors into a single forward calculation by using Microsoft® Goal Seek™, an add-on to Microsoft® Excel that finds a solution by iterative trial-and-error that satisfies calculation constraints introduced by having interdependent mathematical equations. To present a range of potential RBCs, the values were calculated using TRVs scaled to clapper rail body weight (Table 2) and unscaled TRVs (Table 3) and for a range of SUFs. RBCs are also presented for both low and high TRVs; TRV_{low} is based on the NOAEL and TRV_{high} is based on the LOAEL. The selected RBC is conservatively based on TRV_{low} to ensure protection of the most sensitive organisms. Shaded rows in Tables 2 and 3 present the recommended RBCs based on a SUF of 0.3 (1.41 milligrams per kilogram [mg/kg] based on the scaled TRV_{low} and 1.75 mg/kg based on the unscaled TRV_{low}).

To compare this assessment with other ecological risk assessments in the region, the RBC derivation was also conducted using the general exposure parameters from the Hamilton Army Airfield (HAA), Base Realignment and Closure (BRAC) Property Human Health and Ecological Risk Assessment (HHERA) (U.S. Army 2001). These included a slightly larger body weight of 0.39 kg (as opposed to 0.271 kg), a dietary composition consisting of 100% benthic invertebrates (as opposed to 85% invertebrates and 15% plants), a higher sediment ingestion rate of 18% (as opposed to 7.3%), and a slightly higher food ingestion rate (based on elevated body weights) as shown in Table 4. The model was run again both with TRVs scaled for the revised body weight and with unscaled TRVs using the general exposure parameters from the HAA site but the site-specific parameters such as the BAF and SUF from the Site were used. Resulting RBCs (referred below as HAA Assumptions-based RBCs) are similar to the recommended RBCs for the Site (Tables 5 and 6).

The table below presents a summary of the RBCs based on the SUF of 0.3 at the Site, using scaled and unscaled TRVs for the two different sets of exposure parameters.

	Recommended RBCs (mg/kg) (SUF = 0.3)		**HAA Assumptions-based RBCs (mg/kg) (SUF = 0.3)**	
	RBC_{low}	**RBC_{high}**	**RBC_{low}**	**RBC_{high}**
Scaled TRVs	1.41	17.09	1.42	17.09
Unscaled TRVs	1.75	24.73	1.64	23.11

Under the most conservative scenario, the table below presents a summary of the RBCs based on the SUF of 1 at the Site, using scaled and unscaled TRVs for the two different sets of exposure parameters.

	Conservative RBCs (mg/kg) (for SUF = 1)		HAA Assumptions-based RBCs (mg/kg) (SUF =1)	
	RBC_{low}	RBC_{high}	RBC_{low}	RBC_{high}
Scaled TRVs	0.42	5.13	0.43	5.13
Unscaled TRVs	0.53	7.42	0.49	6.93

Conclusions

The currently recommended remediation goals at Yosemite Slough are based on the remediation goals from HPS. At HPS, the ecological remediation goals for the surf scoter were developed using a SUF of 0.5 and a NOAEL-based TRV[2] and resulted in an NTE value of 1.24 mg/kg. The recommended site-specific RBCs calculated in this memorandum (i.e., based on a SUF of 0.3 and BAF = 2 for PCBs) protective of CCR range from 1.41 mg/kg based on the scaled NOAEL-based TRV to 24.73 mg/kg based on the unscaled LOAEL-based TRV. Therefore, because these RBCs are higher than the NTE value of 1.24 mg/kg, the current remediation goals for Yosemite Slough are protective of the CCR.

Moreover, as discussed above, an AWA remediation goal of 0.386 mg/kg was also calculated for HPS, but this value was not ecologically based. Normally, the value calculated as 1.24 mg/kg would be applied as an average within the exposure area and not as a NTE level because foraging species like the surf scoter and CCR are exposed across their foraging areas and not on a point-by-point basis. Therefore, the use of the remediation goal as a NTE value is conservative and protective.

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[2] LOAEL-based TRVs are generally used for non-special status species such as surf scoter and NOAEL-based TRVs are generally used for special status species. Therefore, the assessment at HPS was more conservative than that for other sites.

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Attachments

Table 1	Exposure Parameters for the California Clapper Rail
Table 2a	NOAEL-Based RBCs for California Clapper Rail – PCBs (scaled TRVs)
Table 2b	LOAEL-Based RBCs for California Clapper Rail – PCBs (scaled TRVs)
Table 3a	NOAEL-Based RBCs for California Clapper Rail – PCBs (unscaled TRVs)
Table 3b	LOAEL-Based RBCs for California Clapper Rail – PCBs (unscaled TRVs)
Table 4	Exposure Parameters for the California Clapper Rail from HAA
Table 5a	NOAEL-Based RBCs for California Clapper Rail – PCBs (scaled TRVs and HAA Exposure Parameters)
Table 5a	LOAEL-Based RBCs for California Clapper Rail – PCBs (scaled TRVs and HAA Exposure Parameters)
Table 6a	NOAEL-Based RBCs for California Clapper Rail – PCBs (unscaled TRVs and HAA Exposure Parameters)
Table 6b	LOAEL-Based RBCs for California Clapper Rail – PCBs (unscaled TRVs and HAA Exposure Parameters)

Table 1. Exposure Parameters for the California Clapper Rail (*Rallus longirostris obsoletus*)

Parameter	Symbol	Value	Unit	Reference
Food Ingestion Rate	IR_{food}	0.026	kg/day (dw)	Calculated using body weight of 271 g with equation for food requirement for intake for omnivorous birds (Nagy 2001): [[0.67*(BW)]^0.627]/1000
Sediment Ingestion Rate	IR_{sed}	0.0019	kg/day (dw)	7.3% of food ingestion rate; based on value for least sandpiper (Beyer et al. 1994)
Sediment-to-Invertebrate Bioaccumulation Factor	BAF_{invert}	2	unitless	Calculated for PCBs in Area X (South Basin) at Hunters Point Shipyard (Battelle, BBL, and Neptune & Co. 2005)
Sediment-to-Plant Bioaccumulation Factor	BAF_{plant}	0.033	unitless	Calculated using Travis and Arms (1988) log K_{ow} equation for 7 individual Aroclors and averaged: Log $BAF_{vegetation}$ = 1.588 - 0.578 log K_{ow}. Log K_{ow} values obtained from EPI (USEPA 2011)
Dietary Composition	% diet	85% 15%	invertebrates plants	From Moffitt (1941) for the California clapper rail as referrenced in OEHHA (2012)
Home Range	-	31	acres	Mean home range of the clapper rail in Arizona during breeding season (Conway et al. 1993) as referenced by OEHHA (2012)
Site Use Factor	SUF	0.3	unitless	Assumes entire slough area is used for foraging ~10 acres
Body Weight	BW	0.271	kg	Mean values for the clapper rail from (Hammons et al. 1988) as referenced in OEHHA (2012)
Toxicity Reference Value - low	TRV_{low}	0.09	mg/kg/day	From Platonow & Reinhart (1973) as referenced by Region 9 BTAG (DTSC 2009); based on chicken (BW = 0.8 kg)
Toxicity Reference Value - high	TRV_{high}	1.27	mg/kg/day	From Britton & Huston (1973) as referenced by Region 9 BTAG (DTSC 2009); based on chicken (BW = 1.72 kg)
Body Weight Adjusted TRV - low	Adjusted TRV_{low}	0.07	mg/kg/day	Body-weight adjusted TRV (Sample and Arenal 1999)
Body Weight Adjusted TRV - high	Adjusted TRV_{high}	0.878	mg/kg/day	

Abbreviations:
kg = kilograms
kg/day = kilograms per day
dw = dry weight
g = gram
mg/kg/day = milligrams per kilogram per day
BW = body weight
IR = ingestion rate
BAF = bioaccumulation factor
SUF = site use factor
PCB = polychlorinated biphenyls
TRV = toxicity reference value

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Table 2a. NOAEL-Based RBCs for California Clapper Rail - PCBs (scaled TRVs)

Body Weight (kg)	SUF	BAF		Dietary Composition (%)		Tissue Concentrations (mg/kg)		Daily Ingestion Rate (kg/day dw)	Sediment Ingestion Rate (kg/day dw)	Dietary Dose (mg/kg/day)	TRV (mg/kg/day)	RBC (mg/kg)	HQ
		Plants	Inverts	Plants	Inverts	Plants	Inverts				NOAEL	NOAEL	
0.271	1	0.033	2	15%	85%	0.014	0.849	0.0261	0.0019	0.07	0.07	0.42	1.00
0.271	0.9	0.033	2	15%	85%	0.016	0.941	0.0261	0.0019	0.07	0.07	0.47	1.00
0.271	0.8	0.033	2	15%	85%	0.017	1.059	0.0261	0.0019	0.07	0.07	0.53	1.00
0.271	0.7	0.033	2	15%	85%	0.020	1.210	0.0261	0.0019	0.07	0.07	0.60	1.00
0.271	0.6	0.033	2	15%	85%	0.023	1.412	0.0261	0.0019	0.07	0.07	0.71	1.00
0.271	0.5	0.033	2	15%	85%	0.028	1.694	0.0261	0.0019	0.07	0.07	0.85	1.00
0.271	0.4	0.033	2	15%	85%	0.035	2.117	0.0261	0.0019	0.07	0.07	1.06	1.00
0.271	0.3	0.033	2	15%	85%	0.047	2.823	0.0261	0.0019	0.07	0.07	1.41	1.00
0.271	0.2	0.033	2	15%	85%	0.070	4.235	0.0261	0.0019	0.07	0.07	2.12	1.00
0.271	0.1	0.033	2	15%	85%	0.140	8.470	0.0261	0.0019	0.07	0.07	4.23	1.00
0.271	0.05	0.033	2	15%	85%	0.280	16.940	0.0261	0.0019	0.07	0.07	8.47	1.00
0.271	0.02	0.033	2	15%	85%	0.699	42.349	0.0261	0.0019	0.07	0.07	21.17	1.00
0.271	0.01	0.033	2	15%	85%	1.398	84.699	0.0261	0.0019	0.07	0.07	42.35	1.00

Table 2b. LOAEL-Based RBCs for California Clapper Rail - PCBs (scaled TRVs)

Body Weight (kg)	SUF	BAF		Dietary Composition (%)		Tissue Concentrations (mg/kg)		Daily Ingestion Rate (kg/day dw)	Sediment Ingestion Rate (kg/day dw)	Dietary Dose (mg/kg/day)	TRV (mg/kg/day)	RBC (mg/kg)	HQ
		Plants	Inverts	Plants	Inverts	Plants	Inverts				LOAEL	LOAEL	
0.271	1	0.033	2	15%	85%	0.169	10.3	0.0261	0.0019	0.88	0.878	5.13	1.00
0.271	0.9	0.033	2	15%	85%	0.188	11.4	0.0261	0.0019	0.88	0.878	5.70	1.00
0.271	0.8	0.033	2	15%	85%	0.212	12.8	0.0261	0.0019	0.88	0.878	6.41	1.00
0.271	0.7	0.033	2	15%	85%	0.242	14.7	0.0261	0.0019	0.88	0.878	7.33	1.00
0.271	0.6	0.033	2	15%	85%	0.282	17.1	0.0261	0.0019	0.88	0.878	8.55	1.00
0.271	0.5	0.033	2	15%	85%	0.338	20.5	0.0261	0.0019	0.88	0.878	10.26	1.00
0.271	0.4	0.033	2	15%	85%	0.423	25.6	0.0261	0.0019	0.88	0.878	12.82	1.00
0.271	0.3	0.033	2	15%	85%	0.564	34.2	0.0261	0.0019	0.88	0.878	17.09	1.00
0.271	0.2	0.033	2	15%	85%	0.846	51.3	0.0261	0.0019	0.88	0.878	25.64	1.00
0.271	0.1	0.033	2	15%	85%	1.692	102.6	0.0261	0.0019	0.88	0.878	51.28	1.00
0.271	0.05	0.033	2	15%	85%	3.384	205.1	0.0261	0.0019	0.88	0.878	102.55	1.00
0.271	0.02	0.033	2	15%	85%	8.461	512.8	0.0261	0.0019	0.88	0.878	256.38	1.00
0.271	0.01	0.033	2	15%	85%	16.921	1025.5	0.0261	0.0019	0.88	0.878	512.77	1.00

Notes:

Following inputs to the dietary dose model and the TRV, goal seek was used to calculate a RBC based on an HQ of 1.

shaded row indicates recommended values for Yosemite Slough.

Abbreviations:

kg = kilograms
kg/day = kilograms per day
dw = dry weight
mg/kg/day = milligrams per kilogram per day
BAF = bioaccumulation factor
SUF = site use factor
TRV = toxicity reference value
NOAEL = no observed adverse effect level
LOAEL = lowest observed adverse effect level
HQ = hazard quotient
PCB = polychlorinated biphenyls
RBC = risk-based concentration

Table 3a. NOAEL-Based RBCs for California Clapper Rail - PCBs (unscaled TRVs)

Body Weight (kg)	SUF	BAF		Dietary Composition (%)		Tissue Concentrations (mg/kg)		Daily Ingestion Rate (kg/day dw)	Sediment Ingestion Rate (kg/day dw)	Dietary Dose (mg/kg/day)	TRV (mg/kg/day)	RBC (mg/kg)	HQ
		Plants	Inverts	Plants	Inverts	Plants	Inverts				NOAEL	NOAEL	
0.271	1	0.033	2	15%	85%	0.017	1.052	0.0261	0.0019	0.09	0.09	0.53	1.00
0.271	0.9	0.033	2	15%	85%	0.019	1.169	0.0261	0.0019	0.09	0.09	0.58	1.00
0.271	0.8	0.033	2	15%	85%	0.022	1.315	0.0261	0.0019	0.09	0.09	0.66	1.00
0.271	0.7	0.033	2	15%	85%	0.025	1.502	0.0261	0.0019	0.09	0.09	0.75	1.00
0.271	0.6	0.033	2	15%	85%	0.029	1.753	0.0261	0.0019	0.09	0.09	0.88	1.00
0.271	0.5	0.033	2	15%	85%	0.035	2.103	0.0261	0.0019	0.09	0.09	1.05	1.00
0.271	0.4	0.033	2	15%	85%	0.043	2.629	0.0261	0.0019	0.09	0.09	1.31	1.00
0.271	0.3	0.033	2	15%	85%	0.058	3.506	0.0261	0.0019	0.09	0.09	1.75	1.00
0.271	0.2	0.033	2	15%	85%	0.087	5.259	0.0261	0.0019	0.09	0.09	2.63	1.00
0.271	0.1	0.033	2	15%	85%	0.174	10.517	0.0261	0.0019	0.09	0.09	5.26	1.00
0.271	0.05	0.033	2	15%	85%	0.347	21.034	0.0261	0.0019	0.09	0.09	10.52	1.00
0.271	0.02	0.033	2	15%	85%	0.868	52.586	0.0261	0.0019	0.09	0.09	26.29	1.00
0.271	0.01	0.033	2	15%	85%	1.735	105.172	0.0261	0.0019	0.09	0.09	52.59	1.00

Table 3b. LOAEL-Based RBCs for California Clapper Rail - PCBs (unscaled TRVs)

Body Weight (kg)	SUF	BAF		Dietary Composition (%)		Tissue Concentrations (mg/kg)		Daily Ingestion Rate (kg/day dw)	Sediment Ingestion Rate (kg/day dw)	Dietary Dose (mg/kg/day)	TRV (mg/kg/day)	RBC (mg/kg)	HQ
		Plants	Inverts	Plants	Inverts	Plants	Inverts				LOAEL	LOAEL	
0.271	1	0.033	2	15%	85%	0.245	14.8	0.0261	0.0019	1.27	1.27	7.42	1.00
0.271	0.9	0.033	2	15%	85%	0.272	16.5	0.0261	0.0019	1.27	1.27	8.24	1.00
0.271	0.8	0.033	2	15%	85%	0.306	18.6	0.0261	0.0019	1.27	1.27	9.28	1.00
0.271	0.7	0.033	2	15%	85%	0.350	21.2	0.0261	0.0019	1.27	1.27	10.60	1.00
0.271	0.6	0.033	2	15%	85%	0.408	24.7	0.0261	0.0019	1.27	1.27	12.37	1.00
0.271	0.5	0.033	2	15%	85%	0.490	29.7	0.0261	0.0019	1.27	1.27	14.84	1.00
0.271	0.4	0.033	2	15%	85%	0.612	37.1	0.0261	0.0019	1.27	1.27	18.55	1.00
0.271	0.3	0.033	2	15%	85%	0.816	49.5	0.0261	0.0019	1.27	1.27	24.73	1.00
0.271	0.2	0.033	2	15%	85%	1.224	74.2	0.0261	0.0019	1.27	1.27	37.10	1.00
0.271	0.1	0.033	2	15%	85%	2.449	148.4	0.0261	0.0019	1.27	1.27	74.20	1.00
0.271	0.05	0.033	2	15%	85%	4.898	296.8	0.0261	0.0019	1.27	1.27	148.41	1.00
0.271	0.02	0.033	2	15%	85%	12.244	742.0	0.0261	0.0019	1.27	1.27	371.02	1.00
0.271	0.01	0.033	2	15%	85%	24.488	1484.1	0.0261	0.0019	1.27	1.27	742.05	1.00

Notes:

Following inputs to the dietary dose model and the TRV, goal seek was used to calculate a RBC based on an HQ of 1.

shaded row indicates recommended values for Yosemite Slough.

Abbreviations:

kg = kilograms
kg/day = kilograms per day
dw = dry weight
mg/kg/day = milligrams per kilogram per day
BAF = bioaccumulation factor
SUF = site use factor
TRV = toxicity reference value
NOAEL = no observed adverse effect level
LOAEL = lowest observed adverse effect level
HQ = hazard quotient
PCB = polychlorinated biphenyls
RBC = risk-based concentration

Table 4. Exposure Parameters for the California Clapper Rail (*Rallus longirostris obsoletus*) from HAA

Parameter	Symbol	Value	Unit	Reference
Food Ingestion Rate	IR_{food}	0.033	kg/day (dw)	Calculated using body weight of 390 g with equation for food requirement for intake for omnivorous birds (Nagy 2001): [[0.67*(BW)]^0.627]/1000
Sediment Ingestion Rate	IR_{sed}	0.0059	kg/day (dw)	18% of food ingestion rate; based on value for least sandpiper (Beyer et al. 1994)
Dietary Composition	% diet	100%	invertebrates	Assumption used in US Army (2001)
		0%	plants	
Home Range	-	31	acres	Mean home range of the clapper rail in Arizona during breeding season (Conway et al. 1995) as referenced by OEHHA (2012)
Site Use Factor	SUF	0.3	unitless	Assumes entire slough area is used for foraging ~10 acres
Body Weight	BW	0.39	kg	Mean values for the clapper rail from Albertson (1995) as referrenced in US Army (2001)
Toxicity Reference Value - low	TRV_{low}	0.09	mg/kg/day	From Platonow & Reinhart (1973) as referenced by Region 9 BTAG (DTSC 2009); based on chicken (BW = 0.8 kg)
Toxicity Reference Value - high	TRV_{high}	1.27	mg/kg/day	From Britton & Huston (1973) as referenced by Region 9 BTAG (DTSC 2009); based on chicken (BW = 1.72 kg)
Body Weight Adjusted TRV - low	Adjusted TRV_{low}	0.078	mg/kg/day	Body-weight adjusted TRV (Sample and Arenal 1999)
Body Weight Adjusted TRV - high	Adjusted TRV_{high}	0.944	mg/kg/day	

Note: Values in red were obtained from US Army (2001) Final Human Health and Ecological Risk Assessment at the Hamilton Army Airfield (HAA), BRAC property in Novato, CA.

Abbreviations:
kg = kilograms
kg/day = kilograms per day
g = gram
dw = dry weight
mg/kg/day = milligrams per kilogram per day
IR = ingestion rate
BW = body weight
BAF = bioaccumulation factor
SUF = site use factor
TRV = toxicity reference value
HAA = Hamilton Army Airfield

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Table 5a. NOAEL-Based RBCs for California Clapper Rail - PCBs (scaled TRVs and HAA Exposure Parameters)

Body Weight (kg)	SUF	BAF		Dietary Composition (%)		Tissue Concentrations (mg/kg)		Daily Ingestion Rate (kg/day dw)	Sediment Ingestion Rate (kg/day dw)	Dietary Dose (mg/kg/day)	TRV (mg/kg/day)	RBC (mg/kg)	HQ
		Plants	Inverts	Plants	Inverts	Plants	Inverts				NOAEL	NOAEL	
0.39	1	0.000	2	0%	100%	0.000	0.852	0.0328	0.0059	0.08	0.078	0.43	1.00
0.39	0.9	0.000	2	0%	100%	0.000	0.946	0.0328	0.0059	0.08	0.078	0.47	1.00
0.39	0.8	0.000	2	0%	100%	0.000	1.064	0.0328	0.0059	0.08	0.078	0.53	1.00
0.39	0.7	0.000	2	0%	100%	0.000	1.216	0.0328	0.0059	0.08	0.078	0.61	1.00
0.39	0.6	0.000	2	0%	100%	0.000	1.419	0.0328	0.0059	0.08	0.078	0.71	1.00
0.39	0.5	0.000	2	0%	100%	0.000	1.703	0.0328	0.0059	0.08	0.078	0.85	1.00
0.39	0.4	0.000	2	0%	100%	0.000	2.129	0.0328	0.0059	0.08	0.078	1.06	1.00
0.39	0.3	0.000	2	0%	100%	0.000	2.838	0.0328	0.0059	0.08	0.078	1.42	1.00
0.39	0.2	0.000	2	0%	100%	0.000	4.258	0.0328	0.0059	0.08	0.078	2.13	1.00
0.39	0.1	0.000	2	0%	100%	0.000	8.515	0.0328	0.0059	0.08	0.078	4.26	1.00
0.39	0.05	0.000	2	0%	100%	0.000	17.030	0.0328	0.0059	0.08	0.078	8.52	1.00
0.39	0.02	0.000	2	0%	100%	0.000	42.575	0.0328	0.0059	0.08	0.078	21.29	1.00
0.39	0.01	0.000	2	0%	100%	0.000	85.150	0.0328	0.0059	0.08	0.078	42.58	1.00

Table 5b. LOAEL-Based RBCs for California Clapper Rail - PCBs (scaled TRVs and HAA Exposure Parameters)

Body Weight (kg)	SUF	BAF		Dietary Composition (%)		Tissue Concentrations (mg/kg)		Daily Ingestion Rate (kg/day dw)	Sediment Ingestion Rate (kg/day dw)	Dietary Dose (mg/kg/day)	TRV (mg/kg/day)	RBC (mg/kg)	HQ
		Plants	Inverts	Plants	Inverts	Plants	Inverts				LOAEL	LOAEL	
0.39	1	0.000	2	0%	100%	0.000	10.3	0.0328	0.0059	0.94	0.944	5.13	1.00
0.39	0.9	0.000	2	0%	100%	0.000	11.4	0.0328	0.0059	0.94	0.944	5.70	1.00
0.39	0.8	0.000	2	0%	100%	0.000	12.8	0.0328	0.0059	0.94	0.944	6.41	1.00
0.39	0.7	0.000	2	0%	100%	0.000	14.7	0.0328	0.0059	0.94	0.944	7.33	1.00
0.39	0.6	0.000	2	0%	100%	0.000	17.1	0.0328	0.0059	0.94	0.944	8.55	1.00
0.39	0.5	0.000	2	0%	100%	0.000	20.5	0.0328	0.0059	0.94	0.944	10.26	1.00
0.39	0.4	0.000	2	0%	100%	0.000	25.6	0.0328	0.0059	0.94	0.944	12.82	1.00
0.39	0.3	0.000	2	0%	100%	0.000	34.2	0.0328	0.0059	0.94	0.944	17.09	1.00
0.39	0.2	0.000	2	0%	100%	0.000	51.3	0.0328	0.0059	0.94	0.944	25.64	1.00
0.39	0.1	0.000	2	0%	100%	0.000	102.6	0.0328	0.0059	0.94	0.944	51.28	1.00
0.39	0.05	0.000	2	0%	100%	0.000	205.1	0.0328	0.0059	0.94	0.944	102.55	1.00
0.39	0.02	0.000	2	0%	100%	0.000	512.8	0.0328	0.0059	0.94	0.944	256.38	1.00
0.39	0.01	0.000	2	0%	100%	0.000	1025.5	0.0328	0.0059	0.94	0.944	512.77	1.00

Notes:

Following inputs to the dietary dose model and the TRV, goal seek was used to calculate a RBC based on an HQ of 1.

shaded row could be considered for Yosemite Slough.

Abbreviations:

kg = kilograms
kg/day = kilograms per day
dw = dry weight
mg/kg/day = milligrams per kilogram per day
BAF = bioaccumulation factor; diet was assumed to be 100% invertebrates and 0% plants
SUF = site use factor
TRV = toxicity reference value
NOAEL = no observed adverse effect level
LOAEL = lowest observed adverse effect level
HQ = hazard quotient
HAA = Hamilton Army Airfield
PCB = polychlorinated biphenyls
RBC = risk-based concentration

Table 6a. NOAEL-Based RBCs for California Clapper Rail - PCBs (unscaled TRVs and HAA Exposure Parameters)

Body Weight (kg)	SUF	BAF		Dietary Composition (%)		Tissue Concentrations (mg/kg)		Daily Ingestion Rate (kg/day dw)	Sediment Ingestion Rate (kg/day dw)	Dietary Dose (mg/kg/day)	TRV (mg/kg/day)	RBC (mg/kg)	HQ
		Plants	Inverts	Plants	Inverts	Plants	Inverts				NOAEL	NOAEL	
0.39	1	0.000	2	0%	100%	0.000	0.983	0.0328	0.0059	0.09	0.09	0.49	1.00
0.39	0.9	0.000	2	0%	100%	0.000	1.092	0.0328	0.0059	0.09	0.09	0.55	1.00
0.39	0.8	0.000	2	0%	100%	0.000	1.228	0.0328	0.0059	0.09	0.09	0.61	1.00
0.39	0.7	0.000	2	0%	100%	0.000	1.404	0.0328	0.0059	0.09	0.09	0.70	1.00
0.39	0.6	0.000	2	0%	100%	0.000	1.638	0.0328	0.0059	0.09	0.09	0.82	1.00
0.39	0.5	0.000	2	0%	100%	0.000	1.965	0.0328	0.0059	0.09	0.09	0.98	1.00
0.39	0.4	0.000	2	0%	100%	0.000	2.456	0.0328	0.0059	0.09	0.09	1.23	1.00
0.39	0.3	0.000	2	0%	100%	0.000	3.275	0.0328	0.0059	0.09	0.09	1.64	1.00
0.39	0.2	0.000	2	0%	100%	0.000	4.913	0.0328	0.0059	0.09	0.09	2.46	1.00
0.39	0.1	0.000	2	0%	100%	0.000	9.825	0.0328	0.0059	0.09	0.09	4.91	1.00
0.39	0.05	0.000	2	0%	100%	0.000	19.650	0.0328	0.0059	0.09	0.09	9.83	1.00
0.39	0.02	0.000	2	0%	100%	0.000	49.125	0.0328	0.0059	0.09	0.09	24.56	1.00
0.39	0.01	0.000	2	0%	100%	0.000	98.250	0.0328	0.0059	0.09	0.09	49.13	1.00

Table 6b. LOAEL-Based RBCs for California Clapper Rail - PCBs (unscaled TRVs and HAA Exposure Parameters)

Body Weight (kg)	SUF	BAF		Dietary Composition (%)		Tissue Concentrations (mg/kg)		Daily Ingestion Rate (kg/day dw)	Sediment Ingestion Rate (kg/day dw)	Dietary Dose (mg/kg/day)	TRV (mg/kg/day)	RBC (mg/kg)	HQ
		Plants	Inverts	Plants	Inverts	Plants	Inverts				LOAEL	LOAEL	
0.39	1	0.000	2	0%	100%	0.000	13.9	0.0328	0.0059	1.27	1.27	6.93	1.00
0.39	0.9	0.000	2	0%	100%	0.000	15.4	0.0328	0.0059	1.27	1.27	7.70	1.00
0.39	0.8	0.000	2	0%	100%	0.000	17.3	0.0328	0.0059	1.27	1.27	8.67	1.00
0.39	0.7	0.000	2	0%	100%	0.000	19.8	0.0328	0.0059	1.27	1.27	9.90	1.00
0.39	0.6	0.000	2	0%	100%	0.000	23.1	0.0328	0.0059	1.27	1.27	11.55	1.00
0.39	0.5	0.000	2	0%	100%	0.000	27.7	0.0328	0.0059	1.27	1.27	13.86	1.00
0.39	0.4	0.000	2	0%	100%	0.000	34.7	0.0328	0.0059	1.27	1.27	17.33	1.00
0.39	0.3	0.000	2	0%	100%	0.000	46.2	0.0328	0.0059	1.27	1.27	23.11	1.00
0.39	0.2	0.000	2	0%	100%	0.000	69.3	0.0328	0.0059	1.27	1.27	34.66	1.00
0.39	0.1	0.000	2	0%	100%	0.000	138.6	0.0328	0.0059	1.27	1.27	69.32	1.00
0.39	0.05	0.000	2	0%	100%	0.000	277.3	0.0328	0.0059	1.27	1.27	138.64	1.00
0.39	0.02	0.000	2	0%	100%	0.000	693.2	0.0328	0.0059	1.27	1.27	346.61	1.00
0.39	0.01	0.000	2	0%	100%	0.000	1386.4	0.0328	0.0059	1.27	1.27	693.21	1.00

Notes:

Following inputs to the dietary dose model and the TRV, goal seek was used to calculate a RBC based on an HQ of 1.

shaded row could be considered for Yosemite Slough.

Abbreviations:

kg = kilograms
kg/day = kilograms per day
dw = dry weight
mg/kg/day = milligrams per kilogram per day
BAF = bioaccumulation factor; diet was assumed to be 100% invertebrates and 0% plants
SUF = site use factor
TRV = toxicity reference value
NOAEL = no observed adverse effect level
LOAEL = lowest observed adverse effect level
HQ = hazard quotient
HAA = Hamilton Army Airfield
PCB = polychlorinated biphenyls
RBC = risk-based concentration

A2 Green Sturgeon

Appendix A-2

Supplemental Ecological Risk Evaluation for the Green Sturgeon

The green sturgeon (*Acipenser medirostris*) is an anadromous fish that occurs widely along the western coast of the United States. The rivers, coastal estuaries, and coastal marine waters (to 110 meters depth) designated as critical habitat for the southern distinct population segment (DPS) include all of San Francisco Bay (NOAA 2009). In 2009, the southern DPS species was listed as "threatened" under the Endangered Species Act (ESA). There are no toxicity data available for the green sturgeon to assess whether cleanup goals for Yosemite Slough will be protective of this species. Therefore, this memorandum reviews green sturgeon habitat and documents the potential for green sturgeon to be exposed to sediment in the Yosemite Slough under future habitat conditions.

Yosemite Slough

Yosemite Slough is located just north of Candlestick Park in the southern portion of San Francisco Bay in California. Restoration of the areas surrounding Yosemite Slough as tidal wetlands is planned and the Site itself consists of mudflat and open water. Yosemite Slough will be surrounded by low-lying flora, such as cordgrass (*Spartina spp.*) and pickleweed (*Salicornia virginica*). Further inland, plant species include gumplant (*Grindelia robusta*), saltgrass (*Distichlis spicata*), fat hen (*Chenopodium album*), and alkali heath (*Frankenia salina*). One bird island has been created within the project area. Double Rock island lies further out in the South Basin. Predicted maximum water depths at Yosemite Slough are approximately 1.4 meters at high tide; at low tide, the majority of the Yosemite Slough would essentially be a mudflat without any significant water depth until the opening of the Slough. Forage fish species in the area are anticipated to include the Pacific staghorn sculpin (*Leptocottus armatus*), the yellowfin goby (*Acanthogobius flavimanus*), and the chameleon goby (*Tridentiger trigonocephalus*). As a marsh estuary, typical epifaunal invertebrate species would likely consist of clams and other bivalve mollusks, infaunal species, such as worms and burrowing amphipods, and larger macrofauna crustaceans such as crabs and shrimp.

Green Sturgeon Life History

Mature adult green sturgeon migrate into freshwater to spawn. The site of spawning for the southern DPS green sturgeon is the Sacramento River. Spawning occurs in deep pools in fast, turbulent waters over gravel, cobble, or boulder substrates (NOAA 2007, 2009, 2012). Eggs and larvae develop in freshwater, and are not expected to be in Yosemite Slough. Juveniles feed in fresh and estuarine waters for one to four years. Subadults return to coastal estuarine and marine waters, via San Francisco Bay, where they spend at least six to 10 years before returning to freshwater to spawn for the first time (NOAA 2009). As such, it is possible for juvenile and subadults to utilize San Francisco Bay for many years throughout their lifespan.

Potential for Exposure of Green Sturgeon in Yosemite Slough

The green sturgeon occurs in San Francisco Bay throughout the year and occupies a wide range of depths within the estuary (NOAA 2009). However, fewer adult green sturgeon have been documented in central and southern San Francisco Bay, including the vicinity of Yosemite Slough, than in other portions of the bay and Sacramento Delta (50 CFR Part 226 2009). Additionally, the best available catch data for San Francisco Bay indicate that comparably low numbers of green sturgeon have been caught in both central and southern San Francisco Bay than in the northern portions of the estuary and in the Sacramento River delta (DuBois et al. 2010, 2011, 2012).

The likelihood of southern DPS green sturgeon utilizing Yosemite Slough depends on several physical and biological habitat features such as food resources, water flow, migratory corridors, water and sediment quality, and both seasonal and tide cycle water depth. Green sturgeon also require access to refuge areas, holding areas, and feeding areas as well as the ability to migrate among fresh, estuarine, and marine waters (NOAA 2009). Water flow needs to be sufficient to attract and orient adult sturgeon towards spawning grounds and no barriers (i.e., dams) should impede migratory movements. Studies indicate that intertidal zones within estuaries and protected bays are important habitat for green sturgeon, but that they do not occupy high energy surf zones along the open coast, and would be unlikely to significantly utilize very shallow intertidal areas, such as Yosemite Slough, under low tide conditions due to water depth limitations (50 CFR Part 226 2009).

Kelly et al. (2007) found that subadults and adults in San Francisco Bay primarily occurred at depths of less than 10 meters, either swimming near the surface or foraging in the benthos. While green sturgeon were occasionally found at depths up to 24.3 meters, they generally avoided the deepest waters, spending the majority of their time in the shallower regions of the estuary at a mean depth of 5.3 meters (Kelly et al. 2007). Because no water is anticipated to be in the Slough at low tide, and the area will be essentially a large mudflat, the slough would not be considered suitable/ideal habitat for green sturgeon during those periods.

Food resources for the green sturgeon may be available in Yosemite Slough, but will only be accessible during limited times (i.e., high tide). Green sturgeon feed primarily on benthic invertebrates and fish, such as crangonid and thalassinidean shrimp (especially burrowing ghost shrimp), amphipods, isopods, clams, annelids, crabs, sand lances, and anchovies (NOAA 2009).

Available physiological data for green sturgeon suggest that suitable water and sediment conditions include water temperatures below 24°C for juveniles; salinity of 10 to 33 parts per thousand (ppt); minimum dissolved oxygen of 6.54 milligrams per liter (mg/L); and levels of chemical contaminants in water and sediment that do not adversely affect development, growth, or reproduction (NOAA 2009). Kelly et al. (2007) noted that the habitat tolerance ranges of adult green sturgeon are wide and adaptable and that their movements may be limited only by extreme conditions. They noted sturgeon can experience a change in salinity of 16.2 ppt in a range of 3 days while swimming from estuarine waters to upstream freshwater (Kelly et al. 2007). Salinity of Yosemite Slough should be approximately 32 ppt (consistent with salinities in Central Bay).

Future conditions within Yosemite Slough are not suitable for spawning or migration as the majority of the area is a mudflat and the Slough is not a freshwater habitat. At high tide, although shallower than the mean depth preferred by green sturgeon, the Slough could provide adequate depth for foraging, more likely near the mouth of the Slough, and mainly for juveniles and subadults. The South Basin area encompassing the opening of the Yosemite Slough and outwards towards the bay likely provides more suitable foraging habitat for green sturgeon due to the presence of water throughout the tidal cycle than the interior of the Yosemite Slough.

Conclusion
Fewer adult green sturgeon have been documented in central San Francisco Bay, including the project area, than in other portions of the bay. Future habitat in Yosemite Slough will not be suitable for spawning or migration. Yosemite Slough could possibly support feeding and rearing habitat for southern DPS green sturgeon, but limited water depths would minimize their use of the area to only during high tide conditions and near the mouth of the slough. Although there are no available toxicity data to quantify the protection levels for green sturgeon, these species are expected to have minimal exposure to sediments and constituents in sediment at Yosemite Slough because (1) green sturgeon do not spawn in such habitat (eggs and larvae are not expected); (2) it is tidally influenced and is a mudflat during low tides and therefore not suitable for foraging during those periods; and (3) more suitable habitat is available elsewhere in San Francisco Bay. Furthermore, any constituents currently detected at elevated levels in sediments in Yosemite Slough will be reduced once the remedy is implemented. As a result, the green sturgeon is expected to be adequately protected under future conditions in Yosemite Slough.

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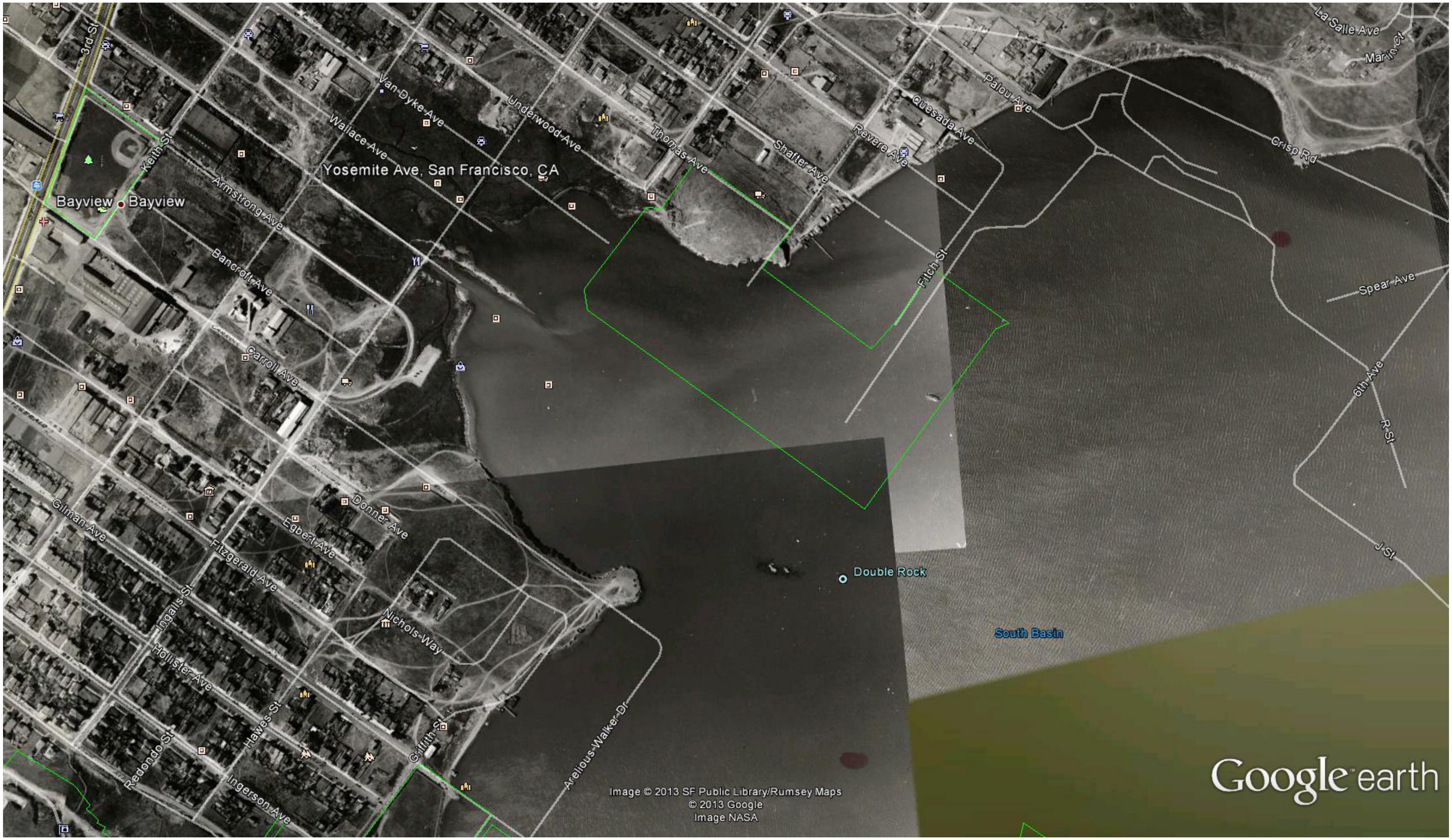
B Aerial Photographs



Google earth

feet 4000
km 1

1938 Aerial Photograph

Google earth

feet 4000
km 1

2011 Aerial Photograph

feet 4000
km 1

2012 Aerial Photograph

C Site Analytical Data

Table C-1 Analytical Data (Arthur D. Little, 1999).

Location ID Depth Interval (ft) Sample Date	Units:	1N Surface 10/20/1998	1N 0 - 1 10/20/1998	1N 1 - 2 10/20/1998	1S Surface 10/20/1998	2N-rep1 Surface 10/20/1998	2N-rep2 Surface 10/20/1998	2N-rep3 Surface 10/20/1998	2N 0 - 1 10/20/1998	2N 1 - 2 10/20/1998
METALS										
Aluminum	mg/kg	45,050	45,294	10,622	50,725	43,308	46,651	42,820	50,244	26,639
Arsenic	mg/kg	9.7	10.4	7.0	9.2	9.8	9.6	8.8	9.5	11.6
Cadmium	mg/kg	1.37	8.63	0.46	0.53	0.86	0.85	0.86	0.92	2.97
Chromium	mg/kg	143	368	51	142	131	134	131	143	154
Copper	mg/kg	108	146	445	109	103	96	100	92	57
Iron	mg/kg	44,136	44,307	15,918	47,306	41,575	41,210	41,462	43,167	32,185
Lead	mg/kg	168	811	38	132	137	135	144	134	266
Mercury	mg/kg	0.70	1.49	0.12	0.53	0.56	0.59	0.57	0.01	0.45
Nickel	mg/kg	93	108	29	98	94	98	95	92	65
Selenium	mg/kg	0.96	1.52	0.16	0.38	0.41	0.38	0.40	0.45	0.55
Silver	mg/kg	0.60	1.2	ND(0.10)	0.50	0.50	0.50	0.60	ND(0.30)	ND(0.30)
Zinc	mg/kg	289	830	157	227	231	226	227	242	288
POLYNUCLEAR AROMATIC HYDROCARBONS (PAHs)										
Naphthalene	ug/kg	48	560	80	39	46	46	48	38	54
C1-Naphthalenes	ug/kg	52	420	27	28	52	54	61	48	50
C2-Naphthalenes	ug/kg	73	710	65	51	76	69	70	88	75
C3-Naphthalenes	ug/kg	50	490	79	38	50	49	48	74	48
C4-Naphthalenes	ug/kg	43	650	88	55	45	49	49	53	48
Acenaphthylene	ug/kg	28	350	73	26	40	35	34	30	42
Acenaphthene	ug/kg	11	210 J	15	7	12	11	12	28	11
Biphenyl	ug/kg	18	210 J	13	13	16	16	15	14	14
Dibenzofuran	ug/kg	12	210 J	11	9	12	10	11	9	9
Fluorene	ug/kg	19	210 J	72	15	22	19	21	26	18
C1-Fluorenes	ug/kg	21	240	59	17	19	21	18	34	30
C2-Fluorenes	ug/kg	47	320	45	25	32	29	24	32	30
C3-Fluorenes	ug/kg	65	1,100	69	53	56	43	48	50	110
Anthracene	ug/kg	66	1,000	250	45	90	71	76	72	140
Phenanthrene	ug/kg	140	740	300	95	200	140	160	190	100
C1-Phenanthrenes/anthracenes	ug/kg	100	1,000	400	82	120	100	110	180	95
C2-Phenanthrenes/anthracenes	ug/kg	110	1,500	200	90	110	91	100	130	120
C3-Phenanthrenes/anthracenes	ug/kg	100	2,200	120	70	84	80	82	89	210
C4-Phenanthrenes/anthracenes	ug/kg	150	2,900	180	110	200	200	190	120	190
Dibenzothiophene	ug/kg	14	210 J	49	11	17	15	14	20	12
C1-Dibenzothiophenes	ug/kg	13	210 J	49	11	16	15	16	24	20
C2-Dibenzothiophenes	ug/kg	31	650	64	28	32	40	34	39	53
C3-Dibenzothiophenes	ug/kg	39	1,100	43	32	37	36	32	36	120

Table C-1 Analytical Data (Arthur D. Little, 1999).

Location ID Depth Interval (ft) Sample Date	Units:	2S Surface 10/20/1998	3N Surface 10/20/1998	3S Surface 10/20/1998	3S 0 - 1 10/20/1998	3S 1 - 2 10/20/1998	4C Surface 10/20/1998	4C 0 - 1 10/20/1998	4C 1 - 2 10/20/1998	4N Surface 10/20/1998
METALS										
Aluminum	mg/kg	36,340	40,282	34,083	47,459	29,910	30,320	33,878	9,499	39,869
Arsenic	mg/kg	8.3	9.1	11.4	11.7	10.7	9.1	10.4	8.1	8.2
Cadmium	mg/kg	1.24	0.89	0.64	1.06	8.0	0.55	0.84	1.75	0.60
Chromium	mg/kg	126	129	122	173	234	107	125	106	120
Copper	mg/kg	79	112	113	100	116	97	87	90	99
Iron	mg/kg	36,226	40,756	41,655	43,250	36,311	37,683	37,880	20,496	38,151
Lead	mg/kg	155	144	156	159	636	129	119	225	119
Mercury	mg/kg	0.58	0.73	0.94	0.43	0.98	0.68	0.41	0.65	0.63
Nickel	mg/kg	78	87	93	94	76	87	85	50	85
Selenium	mg/kg	0.38	0.35	0.33	0.53	1.55	0.29	0.4	0.31	0.33
Silver	mg/kg	0.50	ND(0.50)	0.60	ND(0.50)	0.90	0.40	ND(0.50)	2.0	0.50
Zinc	mg/kg	217	253	242	248	678	220	221	313	214
POLYNUCLEAR AROMATIC HYDROCARBONS (PAHs)										
Naphthalene	ug/kg	54	80	120	52	220	74	49	140	77
C1-Naphthalenes	ug/kg	65	74	110	63	280	71	47	220	72
C2-Naphthalenes	ug/kg	75	100	120	99	410	91	78	310	92
C3-Naphthalenes	ug/kg	56	77	100	84	290	80	50	230	72
C4-Naphthalenes	ug/kg	42	72	91	68	220	63	48	160	67
Acenaphthylene	ug/kg	36	78	120	43	76	120	48	57	78
Acenaphthene	ug/kg	12	29	31	17	54 J	26	14	38	23
Biphenyl	ug/kg	15	21	30	17	54 J	22	14	31	30
Dibenzofuran	ug/kg	11	18	24	12	54 J	18	9	21	15
Fluorene	ug/kg	21	40	51	24	82	45	20	50	34
C1-Fluorenes	ug/kg	20	30	44	25	89	33	24	54	32
C2-Fluorenes	ug/kg	25	37	39	34	150	33	27	64	36
C3-Fluorenes	ug/kg	58	82	42	72	460	79	55	160	67
Anthracene	ug/kg	99	180	200	97	510	160	87	160	140
Phenanthrene	ug/kg	150	400	450	180	340	460	180	240	320
C1-Phenanthrenes/anthracenes	ug/kg	120	260	300	140	390	260	140	240	230
C2-Phenanthrenes/anthracenes	ug/kg	100	230	230	150	500	170	110	270	170
C3-Phenanthrenes/anthracenes	ug/kg	110	170	150	110	760	100	110	290	110
C4-Phenanthrenes/anthracenes	ug/kg	220	380	330	140	800	250	150	350	250
Dibenzothiophene	ug/kg	16	30	34	16	54 J	31	16	28	24
C1-Dibenzothiophenes	ug/kg	17	30	34	20	130	27	20	46	26
C2-Dibenzothiophenes	ug/kg	38	78	78	47	290	54	38	130	58
C3-Dibenzothiophenes	ug/kg	41	55	66	49	690	41	48	170	42

Table C-1 Analytical Data (Arthur D. Little, 1999).

Location ID Depth Interval (ft) Sample Date	Units:	4S Surface 10/20/1998	5A Surface 10/20/1998	5C-rep1 Surface 10/20/1998	5C-rep2 Surface 10/20/1998	5C-rep3 Surface 10/20/1998	5N Surface 10/20/1998	5N 0 - 1 10/20/1998	5N 1 - 2 10/20/1998	5S Surface 10/20/1998
METALS										
Aluminum	mg/kg	44,826	34,720	41,080	33,737	23,647	34,812	29,874	33,376	37,279
Arsenic	mg/kg	9.0	9.2	10.0	10.6	9.0	9.0	8.8	11.7	8.9
Cadmium	mg/kg	0.56	0.58	0.68	0.71	0.90	0.45	1.83	2.28	0.41
Chromium	mg/kg	126	114	122	118	103	111	165	152	114
Copper	mg/kg	103	91	110	98	101	82	108	60	141
Iron	mg/kg	41,183	39,800	39,897	39,153	33,775	35,765	30,682	34,693	42,971
Lead	mg/kg	144	109	117	114	127	101	244	167	92
Mercury	mg/kg	0.61	0.55	0.59	0.58	0.55	0.66	0.95	0.57	0.53
Nickel	mg/kg	90	85	86	86	78	79	74	70	95
Selenium	mg/kg	0.32	0.29	0.29	0.29	0.28	0.28	0.29	0.55	0.31
Silver	mg/kg	ND(0.50)	0.40	ND(0.50)	0.50	0.50	ND(0.50)	0.70	ND(0.30)	ND(0.50)
Zinc	mg/kg	235	200	211	206	214	186	316	233	197
POLYNUCLEAR AROMATIC HYDROCARBONS (PAHs)										
Naphthalene	ug/kg	81	63	63	56	67	51	150	160	40
C1-Naphthalenes	ug/kg	71	47	66	73	160	50	230	150	30
C2-Naphthalenes	ug/kg	96	67	80	97	190	66	250	190	45
C3-Naphthalenes	ug/kg	74	65	59	68	91	53	230	200	47
C4-Naphthalenes	ug/kg	64	50	50	52	80	42	160	260	32
Acenaphthylene	ug/kg	97	49	70	47	69	52	67	120	42
Acenaphthene	ug/kg	20	18	12	16	23	14	24 J	46	10
Biphenyl	ug/kg	20	15	35	18	24	14	38	35	13
Dibenzofuran	ug/kg	14	15	12	11	14	10	24 J	18	9
Fluorene	ug/kg	34	28	24	23	29	22	37	59	18
C1-Fluorenes	ug/kg	32	27	24	23	29	21	56	97	21
C2-Fluorenes	ug/kg	33	28	24	30	31	24	75	150	23
C3-Fluorenes	ug/kg	63	58	47	57	58	48	140	270	40
Anthracene	ug/kg	140	110	96	81	95	91	150	220	60
Phenanthrene	ug/kg	320	240	190	190	180	210	200	230	130
C1-Phenanthrenes/anthracenes	ug/kg	220	170	140	150	150	140	240	340	100
C2-Phenanthrenes/anthracenes	ug/kg	160	140	110	110	140	110	260	490	89
C3-Phenanthrenes/anthracenes	ug/kg	100	100	74	86	110	73	270	520	60
C4-Phenanthrenes/anthracenes	ug/kg	240	130	160	110	150	160	300	570	91
Dibenzothiophene	ug/kg	25	19	16	15	18	16	24	36	12
C1-Dibenzothiophenes	ug/kg	27	20	18	16	20	17	45	63	13
C2-Dibenzothiophenes	ug/kg	53	39	42	30	47	40	110	200	23
C3-Dibenzothiophenes	ug/kg	46	55	31	32	48	32	130	250	26

Table C-1 Analytical Data (Arthur D. Little, 1999).

Location ID Depth Interval (ft) Sample Date	Units:	1N Surface 10/20/1998	1N 0 - 1 10/20/1998	1N 1 - 2 10/20/1998	1S Surface 10/20/1998	2N-rep1 Surface 10/20/1998	2N-rep2 Surface 10/20/1998	2N-rep3 Surface 10/20/1998	2N 0 - 1 10/20/1998	2N 1 - 2 10/20/1998
Fluoranthene	ug/kg	300	2,600	950	270	410	340	350	270	190
Pyrene	ug/kg	440	7,100	1,500	360	510	460	480	420	760
C1-Fluoranthenes/pyrenes	ug/kg	200	4,700	550	140	200	190	210	220	350
C2-Fluoranthenes/pyrenes	ug/kg	180	2,700	200	100	160	140	160	140	230
C3-Fluoranthenes/pyrenes	ug/kg	130	1,700	89	75	95	87	94	94	200
Benzo[a]anthracene	ug/kg	170	1,800	530	130	190	180	200	170	210
Chrysene	ug/kg	200	1,600	520	160	260	220	250	180	180
C1-Chrysenes	ug/kg	130	1,600	260	88	150	130	140	120	190
C2-Chrysenes	ug/kg	120	1,200	100	73	130	120	130	110	170
C3-Chrysenes	ug/kg	110	860	84	69	100	99	100	95	140
C4-Chrysenes	ug/kg	94	780	53	60	88	81	85	80	120
Benzo[b]fluoranthene	ug/kg	480	2,500	760	380	480	430	450	410	520
Benzo[k]fluoranthene	ug/kg	130	890	250	120	130	150	150	100	120
Benzo[e]pyrene	ug/kg	290	2,000	420	230	300	270	300	230	310
Benzo[a]pyrene	ug/kg	340	2,800	710	280	360	340	370	310	400
Perylene	ug/kg	140	700	180	120	140	130	140	100	120
Indeno[1,2,3,-c,d]pyrene	ug/kg	260	1,500	420	220	330	280	320	240	260
Dibenzo[a,h]anthracene	ug/kg	37	280	50	28	45	40	44	28	38
Benzo[g,h,i]perylene	ug/kg	290	1,700	340	250	370	320	360	210	220
Total PAH (41 analytes)	ug/kg	5,505	55,787	10,331	4,237	5,974	5,361	5,924	5,057	6,498
LMW PAHs	ug/kg	1,250	17,190	2,351	950	1,384	1,239	1,273	1,424	1,599
HMW PAHs	ug/kg	4,041	39,010	7,966	3,153	4,448	4,007	4,333	3,527	4,728
LINEAR ALKYLBENZENES (LABs)										
C10B-Phenyl decanes	ug/kg	31	ND(35)	ND(0.35)	18	ND(1.3)	ND(1.2)	38	ND(0.58)	ND(0.60)
C11B-Phenyl undecanes	ug/kg	42	ND(35)	ND(0.35)	25	29	30	30	14	ND(0.60)
C12B-Phenyl dodecanes	ug/kg	30	ND(35)	ND(0.35)	32	ND(1.3)	ND(1.2)	19	ND(0.58)	ND(0.60)
C13B-Phenyl tridecanes	ug/kg	110	ND(35)	13	34	35	83	110	62	170
C14B-Phenyl tetradecanes	ug/kg	ND(1.3)	ND(35)	ND(0.35)	25	77	ND(1.2)	130	30	ND(0.60)
TOTAL PETROLEUM HYDROCARBONS										
Total Resolved Hydrocarbons	mg/kg	96	640	36	59	67	71	66	53	120
Total Petroleum Hydrocarbons	mg/kg	1400	7400	310	790	960	900	920	800	1600
PESTICIDES										
Aldrin	ug/kg	ND(0.26)	ND(0.34)	ND(0.14)	ND(0.24)	ND(0.24)	ND(0.23)	0.71 J	ND(0.22)	ND(0.16)
alpha-Chlordane	ug/kg	25	52	1.3	5.3	8.7	9.4	8.8	8.2	17
gamma-Chlordane	ug/kg	39	110	ND(0.13)	9.2	20	19	18	18	38
cis-Nonachlor	ug/kg	4.2	15	1.1	2.1	3.6	3.2	2.9	3.2	3.7
trans-Nonachlor	ug/kg	10	31	1.1	3.4	5.9	6.2	5.8	5.2	7

Table C-1 Analytical Data (Arthur D. Little, 1999).

Location ID Depth Interval (ft) Sample Date	Units:	2S Surface 10/20/1998	3N Surface 10/20/1998	3S Surface 10/20/1998	3S 0 - 1 10/20/1998	3S 1 - 2 10/20/1998	4C Surface 10/20/1998	4C 0 - 1 10/20/1998	4C 1 - 2 10/20/1998	4N Surface 10/20/1998
Fluoranthene	ug/kg	310	840	890	350	580	790	390	400	710
Pyrene	ug/kg	490	1,000	1,200	510	1,500	1,000	540	950	940
C1-Fluoranthenes/pyrenes	ug/kg	200	540	590	270	990	440	300	580	420
C2-Fluoranthenes/pyrenes	ug/kg	180	320	360	170	780	260	200	490	250
C3-Fluoranthenes/pyrenes	ug/kg	120	190	180	130	720	130	150	360	130
Benzo[a]anthracene	ug/kg	170	540	630	250	400	500	240	350	470
Chrysene	ug/kg	210	690	920	280	420	670	270	400	580
C1-Chrysenes	ug/kg	150	320	370	170	440	270	150	360	270
C2-Chrysenes	ug/kg	150	260	250	140	520	180	140	380	190
C3-Chrysenes	ug/kg	140	200	210	140	470	150	140	350	160
C4-Chrysenes	ug/kg	110	150	170	130	410	130	120	310	120
Benzo[b]fluoranthene	ug/kg	440	950	1,300	560	680	980	480	820	890
Benzo[k]fluoranthene	ug/kg	130	280	420	190	260	330	170	240	280
Benzo[e]pyrene	ug/kg	270	580	780	320	510	600	300	540	540
Benzo[a]pyrene	ug/kg	320	780	1,000	430	670	810	410	620	730
Perylene	ug/kg	120	230	310	160	200	240	140	180	220
Indeno[1,2,3,-c,d]pyrene	ug/kg	270	500	660	310	400	530	300	380	480
Dibenzo[a,h]anthracene	ug/kg	40	82	100	41	69	81	42	66	74
Benzo[g,h,i]perylene	ug/kg	310	540	720	270	400	570	300	350	520
Total PAH (41 analytes)	ug/kg	5,754	11,681	14,033	6,545	18,399	11,121	6,317	11,706	10,177
LMW PAHs	ug/kg	1,401	2,551	2,794	1,559	6,903	2,308	1,382	3,459	2,065
HMW PAHs	ug/kg	4,130	8,992	11,060	4,821	10,419	8,661	4,782	8,126	7,974
LINEAR ALKYLBENZENES (LABs)										
C10B-Phenyl decanes	ug/kg	ND(1.0)	ND(1.1)	32	36	ND(8.9)	16	33	68	ND(1.2)
C11B-Phenyl undecanes	ug/kg	16	ND(1.1)	29	39	130	28	36	ND(3.4)	ND(1.2)
C12B-Phenyl dodecanes	ug/kg	ND(1.0)	ND(1.1)	ND(1.2)	ND(1.2)	ND(8.9)	ND(1.1)	ND(1.0)	ND(3.4)	ND(1.2)
C13B-Phenyl tridecanes	ug/kg	86	61	73	64	970	69	47	48	84
C14B-Phenyl tetradecanes	ug/kg	120	75	44	45	ND(8.9)	38	36	ND(3.4)	52
TOTAL PETROLEUM HYDROCARBONS										
Total Resolved Hydrocarbons	mg/kg	82	80	73	52	380	54	49	100	60
Total Petroleum Hydrocarbons	mg/kg	1000	900	780	810	4200	580	540	1500	670
PESTICIDES										
Aldrin	ug/kg	ND(0.20)	ND(0.22)	ND(0.23)	ND(0.23)	ND(0.17)	ND(0.22)	ND(0.20)	1.8	ND(0.22)
alpha-Chlordane	ug/kg	12	15	10	11	21	7.5	5.4	7.1	7.8
gamma-Chlordane	ug/kg	27	27	17	22	39	12	10	15	14
cis-Nonachlor	ug/kg	5.6	3.1	3.2	3.5	2.6	2.7	2	2.2	2.9
trans-Nonachlor	ug/kg	8.4	7.1	6.8	6.6	6.2	4.4	4.6	10	5

Table C-1 Analytical Data (Arthur D. Little, 1999).

Location ID Depth Interval (ft) Sample Date	Units:	4S Surface 10/20/1998	5A Surface 10/20/1998	5C-rep1 Surface 10/20/1998	5C-rep2 Surface 10/20/1998	5C-rep3 Surface 10/20/1998	5N Surface 10/20/1998	5N 0 - 1 10/20/1998	5N 1 - 2 10/20/1998	5S Surface 10/20/1998
Fluoranthene	ug/kg	670	420	370	360	360	460	370	640	290
Pyrene	ug/kg	910	540	530	500	520	610	820	1,200	400
C1-Fluoranthenes/pyrenes	ug/kg	390	280	220	230	300	260	530	910	190
C2-Fluoranthenes/pyrenes	ug/kg	240	150	170	160	210	180	430	510	120
C3-Fluoranthenes/pyrenes	ug/kg	110	110	98	110	160	90	410	340	82
Benzo[a]anthracene	ug/kg	470	280	250	220	230	290	260	610	170
Chrysene	ug/kg	580	330	300	250	330	360	280	620	200
C1-Chrysenes	ug/kg	260	170	160	120	170	170	250	500	97
C2-Chrysenes	ug/kg	180	130	130	110	160	120	310	300	80
C3-Chrysenes	ug/kg	140	130	100	110	160	100	320	210	74
C4-Chrysenes	ug/kg	120	100	98	92	150	85	270	160	70
Benzo[b]fluoranthene	ug/kg	950	560	590	590	580	640	560	1,200	380
Benzo[k]fluoranthene	ug/kg	340	150	160	140	160	170	170	400	97
Benzo[e]pyrene	ug/kg	580	320	380	330	370	380	420	780	220
Benzo[a]pyrene	ug/kg	780	430	480	440	480	500	520	1,100	300
Perylene	ug/kg	240	150	160	140	160	160	160	300	120
Indeno[1,2,3,-c,d]pyrene	ug/kg	520	320	340	290	440	320	320	630	260
Dibenzo[a,h]anthracene	ug/kg	81	41	48	44	53	47	51	90	28
Benzo[g,h,i]perylene	ug/kg	550	280	380	320	440	340	350	560	250
Total PAH (41 analytes)	ug/kg	10,255	6,509	6,545	6,107	7,353	6,734	10,624	15,889	4,469
LMW PAHs	ug/kg	2,030	1,553	1,443	1,391	1,823	1,356	3,210	4,674	973
HMW PAHs	ug/kg	8,111	4,891	4,964	4,556	5,433	5,282	6,801	11,060	3,428
LINEAR ALKYLBENZENES (LABs)										
C10B-Phenyl decanes	ug/kg	ND(1.1)	ND(0.53)	ND(1.1)	18	ND(1.1)	ND(1.1)	120	73	ND(0.6)
C11B-Phenyl undecanes	ug/kg	ND(1.1)	17	20	25	25	ND(1.1)	120	ND(1.0)	24
C12B-Phenyl dodecanes	ug/kg	ND(1.1)	ND(0.53)	ND(1.1)	ND(0.57)	ND(1.1)	ND(1.1)	ND(3.9)	ND(1.0)	ND(0.6)
C13B-Phenyl tridecanes	ug/kg	64	47	85	45	70	55	180	80	43
C14B-Phenyl tetradecanes	ug/kg	48	ND(0.53)	32	72	ND(1.1)	39	200	ND(1.0)	ND(0.6)
TOTAL PETROLEUM HYDROCARBONS										
Total Resolved Hydrocarbons	mg/kg	58	44	51	55	51	46	99	110	31
Total Petroleum Hydrocarbons	mg/kg	590	560	610	640	740	520	1400	1200	350
PESTICIDES										
Aldrin	ug/kg	ND(0.21)	ND(0.20)	ND(0.22)	ND(0.22)	ND(0.22)	ND(0.21)	ND(0.19)	0.63 J	ND(0.23)
alpha-Chlordane	ug/kg	6	5	5.1	5.5	7.2	6.4	14	5.4	2.7
gamma-Chlordane	ug/kg	11	10	12	14	17	12	27	15	4.7
cis-Nonachlor	ug/kg	ND(0.18)	1.9	2.9	2.9	4.3	2.3	4.4	3.4	1.4
trans-Nonachlor	ug/kg	4.1	4	3.4	3.9	5	5.1	10	6.8	1.5

Table C-1 Analytical Data (Arthur D. Little, 1999).

Location ID Depth Interval (ft) Sample Date	Units:	1N Surface 10/20/1998	1N 0 - 1 10/20/1998	1N 1 - 2 10/20/1998	1S Surface 10/20/1998	2N-rep1 Surface 10/20/1998	2N-rep2 Surface 10/20/1998	2N-rep3 Surface 10/20/1998	2N 0 - 1 10/20/1998	2N 1 - 2 10/20/1998
2,4'-DDT	ug/kg	ND(0.40)	ND(0.53)	ND(0.21)	ND(0.38)	ND(0.38)	ND(0.36)	ND(0.36)	ND(0.35)	ND(0.24)
4,4'-DDT	ug/kg	1.1	ND(0.75)	ND(0.30)	ND(0.53)	1.7	0.88	2.6	ND(0.49	ND(0.34)
2,4'-DDE	ug/kg	ND(0.40)	ND(0.53)	3.2	ND(0.38)	ND(0.38)	ND(0.36)	ND(0.36)	ND(0.35)	28
4,4'-DDE	ug/kg	60	670	39	23	44	42	44	44	88
2,4'-DDD	ug/kg	ND(0.24)	280	1	3	5.1	4.2	4.4	4.4	ND(0.15)
4,4'-DDD	ug/kg	28	480	7.4	17	23	23	27	16	ND(0.34)
Dieldrin	ug/kg	58	370	21	28	46	46	46	44	81
Endrin	ug/kg	ND(0.24)	ND(0.32)	ND(0.13)	ND(0.23)	ND(0.23)	ND(0.22)	ND(0.21)	ND(0.21)	ND(0.15)
Heptachlor	ug/kg	0.58	ND(0.32)	ND(0.13)	ND(0.23)	0.76 J	ND(0.22)	0.71 J	ND(0.21)	ND(0.15)
Heptachlor Epoxide	ug/kg	ND(0.24)	ND(0.32)	ND(0.13)	ND(0.23)	ND(0.23)	ND(0.22)	ND(0.21)	ND(0.21)	ND(0.15)
Lindane	ug/kg	ND(0.18)	ND(0.23)	ND(0.094)	ND(0.17)	ND(0.17)	ND(0.16)	ND(0.16)	ND(0.15)	ND(0.11)
Mirex	ug/kg	ND(0.12)	ND(0.16)	ND(0.064)	ND(0.11)	ND(0.11)	ND(0.11)	ND(0.11)	ND(0.10)	ND(0.074)
POLYCHLORINATED BIPHENYLS (PCBs) - Congener Method										
PCB-8	ug/kg	1.5	5.5	ND(0.09)	ND(0.16)	ND(0.16)	ND(0.15)	ND(0.15)	ND(0.15)	1.4
PCB-18	ug/kg	1.5	7.2	0.52	1.3	1.6	1.4	1.6	1.3	2.1
BCB-28	ug/kg	5	9.2	1.4	3.9	5.3	4.6	5.2	4.4	3.2
PCB-44	ug/kg	8	67	3.9	3.5	6.6	6	6.8	5.9	12
PCB-52	ug/kg	16	77	8.9	5.9	13	12	13	12	24
PCB-66	ug/kg	ND(0.13)	230	15	16	24	23	24	24	39
PCB-77	ug/kg	ND(0.19)	ND(0.26)	ND(0.10)	ND(0.18)	ND(0.18)	ND(0.17)	ND(0.17)	ND(0.17)	ND(0.12)
PCB-101	ug/kg	50	130	22	27	46	46	46	43	56
PCB-105	ug/kg	28	140	7.8	12	20	20	21	18	26
PCB-118	ug/kg	51	80	19	26	43	44	45	40	57
PCB-126	ug/kg	ND(0.30)	ND(0.39)	ND(0.16)	ND(0.28)	ND(0.28)	ND(0.26)	ND(0.26)	ND(0.26)	ND(0.18)
PCB-128	ug/kg	19	89	7.4	9.9	16	15	14	15	19
PCB-138	ug/kg	120	280	56	65	110	110	110	110	140
PCB-153	ug/kg	82	350	37	50	74	72	73	69	84
PCB-170	ug/kg	52	280	26	32	48	47	47	46	69
PCB-180	ug/kg	69	390	41	42	65	62	66	61	98
PCB-187	ug/kg	42	160	19	27	39	38	39	36	41
PCB-195	ug/kg	9.9	36	3.6	6.3	9	9.5	9.6	9.7	9.1
PCB-206	ug/kg	5.1	18	2.1	3.5	4.8	4.9	5	5.8	5
PCB-209	ug/kg	3.6	7.6	0.77	2.5	2.9	3.4	2.8	2.5	2.7
Total PCBs (18 congeners)	ug/kg	560	2,400	270	330	530	520	530	500	690
Total PCBs (20 congeners)	ug/kg	560	2,400	270	330	530	520	530	500	690

Table C-1 Analytical Data (Arthur D. Little, 1999).

Location ID Depth Interval (ft) Sample Date	Units:	2S Surface 10/20/1998	3N Surface 10/20/1998	3S Surface 10/20/1998	3S 0 - 1 10/20/1998	3S 1 - 2 10/20/1998	4C Surface 10/20/1998	4C 0 - 1 10/20/1998	4C 1 - 2 10/20/1998	4N Surface 10/20/1998
2,4'-DDT	ug/kg	ND(0.30)	ND(0.34)	ND(0.36)	ND(0.35)	ND(0.27)	ND(0.34)	ND(0.32)	ND(0.25)	ND(0.35)
4,4'-DDT	ug/kg	ND(0.43)	3.6	7.1	2.4	ND(0.38)	4.5	1.1	24	36
2,4'-DDE	ug/kg	26	ND(0.34)	ND(0.36)	ND(0.35)	ND(0.27)	ND(0.34)	ND(0.32)	ND(0.25)	ND(0.35)
4,4'-DDE	ug/kg	80	32	24	34	66	19	21	30	23
2,4'-DDD	ug/kg	4.1	5.9	3.7	4.6	39	2.8	3	ND(0.15)	3.8
4,4'-DDD	ug/kg	32	29	25	29	130	26	17	28	33
Dieldrin	ug/kg	110	42	32	58	120	35	26	60	30
Endrin	ug/kg	ND(0.18)	ND(0.20)	ND(0.22)	ND(0.21)	ND(0.16)	ND(0.20)	ND(0.19)	ND(0.15)	ND(0.21)
Heptachlor	ug/kg	1.1	ND(0.20)	ND(0.22)	ND(0.21)	1.2	0.68 J	ND(0.19)	ND(0.15)	0.70 J
Heptachlor Epoxide	ug/kg	ND(0.18)	ND(0.20)	ND(0.22)	ND(0.21)	ND(0.16)	ND(0.20)	ND(0.19)	ND(0.15)	ND(0.21)
Lindane	ug/kg	ND(0.13)	ND(0.15)	ND(0.16)	ND(0.16)	ND(0.12)	ND(0.15)	ND(0.14)	ND(0.11)	ND(0.15)
Mirex	ug/kg	ND(0.091)	ND(0.10)	ND(0.11)	ND(0.11)	ND(0.081)	ND(0.10)	ND(0.096)	ND(0.076)	ND(0.10)
POLYCHLORINATED BIPHENYLS (PCBs) - Congener Method										
PCB-8	ug/kg	ND(0.13)	ND(0.14)	1.7	2.2	1.5	ND(0.14)	1.4	1.5	ND(0.15)
PCB-18	ug/kg	3	1.6	2.5	2.2	2.4	2.5	1.9	2.7	2.4
BCB-28	ug/kg	7	3.3	6	4.9	3.7	6.3	3.8	4.4	5.8
PCB-44	ug/kg	19	3.2	4.8	6.7	13	6.2	5.1	7.4	5.1
PCB-52	ug/kg	36	6.5	8.4	15	21	11	11	18	9.1
PCB-66	ug/kg	52	23	19	22	24	24	18	27	18
PCB-77	ug/kg	ND(0.15)	ND(0.16)	ND(0.17)	ND(0.17)	ND(0.13)	ND(0.16)	ND(0.15)	ND(0.12)	ND(0.17)
PCB-101	ug/kg	83	37	30	38	37	33	28	38	30
PCB-105	ug/kg	38	16	11	14	15	13	11	17	12
PCB-118	ug/kg	95	31	27	34	8.2	33	25	32	27
PCB-126	ug/kg	ND(0.22)	ND(0.25)	ND(0.27)	ND(0.26)	ND(0.20)	ND(0.25)	ND(0.24)	ND(0.19)	ND(0.26)
PCB-128	ug/kg	25	12	10	12	11	9.7	9	11	10
PCB-138	ug/kg	150	110	85	100	89	78	71	98	80
PCB-153	ug/kg	100	70	59	66	40	53	51	78	58
PCB-170	ug/kg	55	50	41	44	22	32	35	42	38
PCB-180	ug/kg	76	67	56	60	30	49	48	61	56
PCB-187	ug/kg	48	39	32	35	17	28	28	37	32
PCB-195	ug/kg	9.3	9.4	6.7	5.1	3.3	5.6	5.3	7	6.5
PCB-206	ug/kg	5.3	9.5	4.3	4.3	1.8	4	3.9	3.6	4
PCB-209	ug/kg	2.3	4.1	1.7	2.8	1.6	1.8	1.7	0.78	1.7
Total PCBs (18 congeners)	ug/kg	800	490	410	470	340	390	360	480	380
Total PCBs (20 congeners)	ug/kg	800	490	410	470	340	390	360	490	400

Table C-1 Analytical Data (Arthur D. Little, 1999).

Location ID Depth Interval (ft) Sample Date	Units:	4S Surface 10/20/1998	5A Surface 10/20/1998	5C-rep1 Surface 10/20/1998	5C-rep2 Surface 10/20/1998	5C-rep3 Surface 10/20/1998	5N Surface 10/20/1998	5N 0 - 1 10/20/1998	5N 1 - 2 10/20/1998	5S Surface 10/20/1998
2,4'-DDT	ug/kg	ND(0.33)	ND(0.32)	ND(0.34)	ND(0.34)	ND(0.34)	ND(0.33)	ND(0.29)	ND(0.31)	ND(0.36)
4,4'-DDT	ug/kg	2.9	2.3	3	0.91	4.7	23	3.6	36	1.1
2,4'-DDE	ug/kg	ND(0.33)	ND(0.32)	ND(0.34)	ND(0.34)	0.34	0.33	ND(0.29)	ND(0.29)	ND(0.36)
4,4'-DDE	ug/kg	18	20	18	19	20	22	40	80	6.2
2,4'-DDD	ug/kg	3	2.6	3.4	ND(0.20)	4	3.2	9.5	9.1	1.5
4,4'-DDD	ug/kg	19	14	21	21	24	22	230	51	9.2
Dieldrin	ug/kg	26	29	26	33	33	29	98	110	12
Endrin	ug/kg	ND(0.20)	ND(0.19)	ND(0.20)	ND(0.20)	ND(0.20)	ND(0.20)	ND(0.18)	ND(0.19)	ND(0.22)
Heptachlor	ug/kg	ND(0.20)	ND(0.19)	0.68 J	0.68 J	0.68 J	0.65 J	ND(0.18)	ND(0.19)	ND(0.22)
Heptachlor Epoxide	ug/kg	ND(0.20)	ND(0.19)	ND(0.20)	ND(0.20)	ND(0.20)	ND(0.20)	ND(0.18)	ND(0.19)	ND(0.22)
Lindane	ug/kg	ND(0.14)	ND(0.14)	0.68 J	ND(0.15)	ND(0.15)	ND(0.14)	ND(0.13)	ND(0.14)	ND(0.16)
Mirex	ug/kg	ND(0.096)	ND(0.096)	ND(0.10)	ND(0.10)	ND(0.10)	ND(0.098)	ND(0.088)	ND(0.094)	ND(0.11)
POLYCHLORINATED BIPHENYLS (PCBs) - Congener Method										
PCB-8	ug/kg	ND(0.14)	ND(0.13)	ND(0.14)	ND(0.14)	ND(0.14)	ND(0.14)	1.6	1.7	ND(0.15)
PCB-18	ug/kg	2.2	5.2	3.9	3.4	6.3	1.8	3.2	4.1	11
BCB-28	ug/kg	5.4	8.8	7.2	7.4	14	4.8	5.9	6.3	17
PCB-44	ug/kg	4.1	8.2	5.3	7	8.8	5	7.7	14	8
PCB-52	ug/kg	7.7	13	8.1	12	14	9.6	18	27	10
PCB-66	ug/kg	15	18	19	22	25	16	29	46	13
PCB-77	ug/kg	ND(0.16)	ND(0.15)	ND(0.16)	ND(0.16)	ND(0.16)	ND(0.16)	ND(0.14)	ND(0.15)	ND(0.16)
PCB-101	ug/kg	24	27	30	35	36	27	48	64	16
PCB-105	ug/kg	9.8	11	12	12	15	10	17	27	5.5
PCB-118	ug/kg	21	24	23	28	29	22	35	64	12
PCB-126	ug/kg	ND(0.24)	ND(0.24)	ND(0.25)	ND(0.25)	ND(0.25)	ND(0.24)	ND(0.22)	ND(0.23)	ND(0.24)
PCB-128	ug/kg	8.4	8.4	9.1	11	11	7.6	13	19	4.9
PCB-138	ug/kg	71	69	85	96	100	69	150	180	42
PCB-153	ug/kg	48	47	57	63	71	58	100	120	30
PCB-170	ug/kg	32	29	41	47	54	38	84	85	20
PCB-180	ug/kg	46	42	59	67	77	55	120	120	29
PCB-187	ug/kg	27	26	34	37	42	32	59	56	18
PCB-195	ug/kg	5.8	4.7	7.2	7.8	8.4	7.4	13	13	3.4
PCB-206	ug/kg	3.7	3.3	4	5	5.4	3.8	8.3	7	2.6
PCB-209	ug/kg	1.8	1.5	2.1	2.4	5.4	1.7	42	2.7	1.3
Total PCBs (18 congeners)	ug/kg	330	350	410	460	520	370	750	860	240
Total PCBs (20 congeners)	ug/kg	330	350	410	460	520	370	750	860	240

Table C-1 Analytical Data (Arthur D. Little, 1999).

Location ID Depth Interval (ft) Sample Date	Units:	1N Surface 10/20/1998	1N 0 - 1 10/20/1998	1N 1 - 2 10/20/1998	1S Surface 10/20/1998	2N-rep1 Surface 10/20/1998	2N-rep2 Surface 10/20/1998	2N-rep3 Surface 10/20/1998	2N 0 - 1 10/20/1998	2N 1 - 2 10/20/1998
POLYCHLORINATED BIPHENYLS (PCBs) - Aroclor Method										
Aroclor 1016	ug/kg	ND(16)	ND(21)	ND(8.5)	ND(15)	ND(15)	ND(14)	ND(14)	ND(14)	ND(9.8)
Aroclor 1221	ug/kg	ND(16)	ND(21)	ND(8.5)	ND(15)	ND(15)	ND(14)	ND(14)	ND(14)	ND(9.8)
Aroclor 1232	ug/kg	ND(16)	ND(21)	ND(8.5)	ND(15)	ND(15)	ND(14)	ND(14)	ND(14)	ND(9.8)
Aroclor 1242	ug/kg	ND(16)	ND(21)	ND(8.5)	ND(15)	ND(15)	ND(14)	ND(14)	ND(14)	ND(9.8)
Aroclor 1248	ug/kg	ND(16)	ND(21)	ND(8.5)	ND(15)	ND(15)	ND(14)	ND(14)	ND(14)	ND(9.8)
Aroclor 1254	ug/kg	900	14,000	290	290	510	480	640	510	790
Aroclor 1260	ug/kg	670	10,000	270	420	620	600	620	480	630
Total PCBs (Aroclor method)	ug/kg	1,570	24,000	560	710	1,130	1,080	1,260	990	1,420

Table C-1 Analytical Data (Arthur D. Little, 1999).

Location ID Depth Interval (ft) Sample Date	Units:	2S Surface 10/20/1998	3N Surface 10/20/1998	3S Surface 10/20/1998	3S 0 - 1 10/20/1998	3S 1 - 2 10/20/1998	4C Surface 10/20/1998	4C 0 - 1 10/20/1998	4C 1 - 2 10/20/1998	4N Surface 10/20/1998
POLYCHLORINATED BIPHENYLS (PCBs) - Aroclor Method										
Aroclor 1016	ug/kg	ND(12)	ND(14)	ND(14)	ND(100)	ND(100)	ND(14)	ND(100)	ND(100)	ND(14)
Aroclor 1221	ug/kg	ND(12)	ND(14)	ND(14)	ND(100)	ND(100)	ND(14)	ND(100)	ND(100)	ND(14)
Aroclor 1232	ug/kg	ND(12)	ND(14)	ND(14)	ND(100)	ND(100)	ND(14)	ND(100)	ND(100)	ND(14)
Aroclor 1242	ug/kg	ND(12)	ND(14)	ND(14)	ND(100)	ND(100)	ND(14)	ND(100)	ND(100)	ND(14)
Aroclor 1248	ug/kg	ND(12)	ND(14)	ND(14)	ND(100)	ND(100)	ND(14)	ND(100)	ND(100)	ND(14)
Aroclor 1254	ug/kg	670	550	440	570	920	480	350	500 J	420
Aroclor 1260	ug/kg	350	690	540	500 J	500 J	440	350	500 J	510
Total PCBs (Aroclor method)	ug/kg	1,020	1,240	980	1,070	1,420	920	700	1,000	930

Table C-1 Analytical Data (Arthur D. Little, 1999).

Location ID Depth Interval (ft) Sample Date	Units:	4S Surface 10/20/1998	5A Surface 10/20/1998	5C-rep1 Surface 10/20/1998	5C-rep2 Surface 10/20/1998	5C-rep3 Surface 10/20/1998	5N Surface 10/20/1998	5N 0 - 1 10/20/1998	5N 1 - 2 10/20/1998	5S Surface 10/20/1998
POLYCHLORINATED BIPHENYLS (PCBs) - Aroclor Method										
Aroclor 1016	ug/kg	ND(13)	ND(13)	ND(14)	ND(14)	ND(14)	ND(13)	ND(100)	ND(100)	ND(14)
Aroclor 1221	ug/kg	ND(13)	ND(13)	ND(14)	ND(14)	ND(14)	ND(13)	ND(100)	ND(100)	ND(14)
Aroclor 1232	ug/kg	ND(13)	ND(13)	ND(14)	ND(14)	ND(14)	ND(13)	ND(100)	ND(100)	ND(14)
Aroclor 1242	ug/kg	ND(13)	ND(13)	ND(14)	ND(14)	ND(14)	ND(13)	ND(100)	ND(100)	ND(14)
Aroclor 1248	ug/kg	ND(13)	ND(13)	ND(14)	ND(14)	ND(14)	ND(13)	ND(100)	ND(100)	ND(14)
Aroclor 1254	ug/kg	340	350	360	440	440	360	580	890	170
Aroclor 1260	ug/kg	420	320	530	580	560	480	880	820	220
Total PCBs (Aroclor method)	ug/kg	760	670	890	1,020	1,000	840	1,460	1,710	390

Notes:

1. Reference: Arthur D. Little, Inc. 1999. Sediment Investigation at Yosemite Creek, Fall 1998. Prepared for San Francisco Bay Regional Water Quality Control Board. May 1999.
2. ND(0.09) - compound not detected. Value in parentheses represents the reported detection limit.
3. J - detected result was between the method reporting limit and the reported detection limit.
4. LMW PAHs calculated by the sum of acenaphthene, acenaphthyene, anthracenes, fluorenes, and phenanthrenes.
5. HMW PAHs calculated by the sum of fluoranthenes, pyrenes, benzo[a]anthracene, chrysenes

Table C-2 Analytical Data (Battelle, 2004).

Location ID:		1N	1S	2N	2S	3N	3S	4C	5N
Depth Interval (ft):		Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Sample Date:	Units:	10/14/1999	10/14/1999	10/14/1999	10/14/1999	10/13/1999	10/13/1999	10/13/1999	10/13/1999
METALS									
Aluminum	mg/kg	47,072	48,736	38,657	42,587	31,601	47,958	45,297	32,952
Arsenic	mg/kg	10.6	9.3	8.0	7.6	5.2	10.7	8.4	7.5
Cadmium	mg/kg	1.4	0.73	0.60	0.64	0.65	0.75	0.53	1.3
Chromium	mg/kg	146	132	121	136	103	136	123	135
Copper	mg/kg	106	107	77	78	96	104	92	93
Iron	mg/kg	46,212	44,210	42,200	39,063	31,245	40,942	40,111	33,954
Lead	mg/kg	174	138	138	120	105	135	103	154
Mercury	mg/kg	0.36	0.44	0.42	0.37	0.35	0.54	0.49	0.46
Nickel	mg/kg	96	89	92	112	66	96	90	75
Selenium	mg/kg	0.80	0.47	0.51	0.32	0.22	0.37	0.37	0.37
Silver	mg/kg	1.1	0.86	0.71	0.73	0.72	0.87	0.86	0.76
Zinc	mg/kg	287	227	192	198	200	229	195	211
POLYNUCLEAR AROMATIC HYDROCARBONS (PAHs)									
Naphthalene	ug/kg	33	28	43	30	31	100	48	44
C1-Naphthalenes	ug/kg	36	27	33	34	32	100	34	45
C2-Naphthalenes	ug/kg	49	36	43	48	46	91	52	68
C3-Naphthalenes	ug/kg	36	31	28	38	39	66	42	56
C4-Naphthalenes	ug/kg	22	21	21	27	29	40	29	38
Acenaphthylene	ug/kg	15	13	17	13	19	36	29	23
Acenaphthene	ug/kg	7.2	6.8	7.2	8.0	17	46	11	14
Fluorene	ug/kg	14	11	12	14	21	61	19	18
C1-Fluorenes	ug/kg	16	13	13	14	17	25	16	19
C2-Fluorenes	ug/kg	26	23	22	25	32	42	27	28
C3-Fluorenes	ug/kg	43	37	29	34	56	84	44	56
Anthracene	ug/kg	38	27	31	35	71	90	58	52
Phenanthrene	ug/kg	110	80	98	110	230	370	180	200
C1-Phenanthrenes/anthracenes	ug/kg	80	66	66	81	150	190	120	120
C2-Phenanthrenes/anthracenes	ug/kg	72	65	61	74	140	140	95	100
C3-Phenanthrenes/anthracenes	ug/kg	72	59	48	62	92	95	70	85
C4-Phenanthrenes/anthracenes	ug/kg	87	75	48	58	110	110	84	98
Dibenzothiophene	ug/kg	10	8.8	9.0	10	15	27	13	13
C1-Dibenzothiophenes	ug/kg	12	11	10	14	18	26	18	18
C2-Dibenzothiophenes	ug/kg	25	22	19	24	30	42	28	30
C3-Dibenzothiophenes	ug/kg	31	34	22	29	32	42	34	44
Fluoranthene	ug/kg	280	250	240	250	710	660	470	420
Pyrene	ug/kg	410	350	350	360	800	900	680	580

Table C-2 Analytical Data (Battelle, 2004).

Location ID:		1N	1S	2N	2S	3N	3S	4C	5N
Depth Interval (ft):		Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Sample Date:	Units:	4/20/2000	4/20/2000	4/20/2000	4/20/2000	4/20/2000	4/20/2000	4/19/2000	4/19/2000
METALS									
Aluminum	mg/kg	49,405	48,714	46,196	38,897	19,588	43,075	41,900	28,625
Arsenic	mg/kg	12.0	12.0	7.6	8.3	5.5	12.0	9.1	5.7
Cadmium	mg/kg	1.7	0.68	0.67	0.72	0.66	0.63	0.63	0.77
Chromium	mg/kg	164	143	144	155	93	130	122	109
Copper	mg/kg	113	110	112	85	97	98	90	81
Iron	mg/kg	52,433	52,413	51,148	44,360	26,173	46,217	44,006	37,568
Lead	mg/kg	197	136	160	130	124	119	107	122
Mercury	mg/kg	0.76	0.55	0.64	0.67	0.38	0.72	0.56	1.21
Nickel	mg/kg	105	105	105	152	56	93	89	79
Selenium	mg/kg	0.61	0.50	0.49	0.24	0.16	0.42	0.32	0.25
Silver	mg/kg	ND(0.50)	0.59	0.62	0.52	0.48	0.55	0.60	0.78
Zinc	mg/kg	316	253	252	219	201	225	209	195
POLYNUCLEAR AROMATIC HYDROCARBONS (PAHs)									
Naphthalene	ug/kg	43	36	36	57	30	50	59	81
C1-Naphthalenes	ug/kg	36	23	31	37	33	34	41	74
C2-Naphthalenes	ug/kg	53	34	45	53	51	50	58	90
C3-Naphthalenes	ug/kg	38	28	32	38	37	42	48	65
C4-Naphthalenes	ug/kg	26	23	23	29	23	28	33	50
Acenaphthylene	ug/kg	20	20	20	26	17	30	37	37
Acenaphthene	ug/kg	8.1	7.6	10	10	8.0	15	19	180
Fluorene	ug/kg	17	15	17	19	14	22	28	150
C1-Fluorenes	ug/kg	17	13	16	17	12	18	22	63
C2-Fluorenes	ug/kg	29	23	25	29	21	25	28	95
C3-Fluorenes	ug/kg	51	41	39	53	43	48	52	120
Anthracene	ug/kg	47	40	50	62	51	72	94	320
Phenanthrene	ug/kg	130	100	150	160	140	210	290	1,000
C1-Phenanthrenes/anthracenes	ug/kg	100	81	100	120	130	150	190	410
C2-Phenanthrenes/anthracenes	ug/kg	100	84	85	110	130	130	140	310
C3-Phenanthrenes/anthracenes	ug/kg	100	72	69	98	120	110	100	220
C4-Phenanthrenes/anthracenes	ug/kg	140	100	88	140	140	150	140	280
Dibenzothiophene	ug/kg	13	11	12	14	11	16	22	62
C1-Dibenzothiophenes	ug/kg	18	15	14	19	17	22	26	55
C2-Dibenzothiophenes	ug/kg	32	26	26	34	30	37	43	71
C3-Dibenzothiophenes	ug/kg	50	33	28	45	36	44	47	60
Fluoranthene	ug/kg	300	280	300	390	260	480	600	2,300
Pyrene	ug/kg	440	400	410	540	370	660	820	2,100

Table C-2 Analytical Data (Battelle, 2004).

Location ID:		1N	1S	2N	2S	3N	3S	4C	5N
Depth Interval (ft):		Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Sample Date:	Units:	10/14/1999	10/14/1999	10/14/1999	10/14/1999	10/13/1999	10/13/1999	10/13/1999	10/13/1999
C1-Fluoranthenes/pyrenes	ug/kg	200	160	160	150	420	400	280	260
C2-Fluoranthenes/pyrenes	ug/kg	140	120	95	100	220	230	160	200
C3-Fluoranthenes/pyrenes	ug/kg	100	96	60	76	120	160	100	140
Benzo[a]anthracene	ug/kg	140	110	140	140	380	350	260	220
Chrysene	ug/kg	170	150	180	160	360	400	290	260
C1-Chrysenes	ug/kg	100	83	88	95	160	200	120	150
C2-Chrysenes	ug/kg	100	90	65	99	110	160	100	150
C3-Chrysenes	ug/kg	97	93	61	87	96	150	94	140
C4-Chrysenes	ug/kg	69	60	44	56	64	93	59	95
Benzo[b]fluoranthene	ug/kg	400	330	320	310	620	700	560	480
Benzo[k]fluoranthene	ug/kg	110	79	120	80	180	220	140	130
Benzo[e]pyrene	ug/kg	240	190	200	200	340	430	330	280
Benzo[a]pyrene	ug/kg	270	230	260	230	470	570	450	380
Perylene	ug/kg	110	94	120	84	140	180	150	110
Indeno[1,2,3,-c,d]pyrene	ug/kg	260	230	220	230	330	480	370	300
Dibenzo[a,h]anthracene	ug/kg	35	29	37	35	60	77	55	48
Benzo[g,h,i]perylene	ug/kg	280	240	240	260	340	520	400	320
Biphenyl	ug/kg	11	9.6	10	10	9.1	22	12	10
Total PAHs (41 compounds)	ug/kg	4,345	3,679	3,680	3,784	7,147	8,703	6,119	5,832
LMW PAHs	ug/kg	845	704	690	792	1,236	1,845	1,063	1,179
HMW PAHs	ug/kg	3,511	2,984	3,000	3,002	5,920	6,880	5,068	4,663
PESTICIDES									
Aldrin	ug/kg	ND(0.80)	ND(0.78)	ND(0.72)	ND(0.68)	ND(0.55)	ND(0.70)	ND(0.68)	ND(0.58)
alpha-Chlordane	ug/kg	22	7.7	5.9	10	6.0	8.7	4.6	8.5
gamma-Chlordane	ug/kg	42	14	13	29	12	18	9	19
cis-Nonachlor	ug/kg	6.7	4.2	3.4	10	3.3	4.6	2.6	5.3
trans-Nonachlor	ug/kg	11	5.8	3.4	5.4	3.4	4.6	2.6	4.6
Total Chlordane (4	ug/kg	82	32	26	54	25	36	18	37
Heptachlor	ug/kg	1.4	0.44	0.54	0.23	0.23	1.7	0.44	0.36
Heptachlor Epoxide	ug/kg	ND(0.75)	ND(0.73)	ND(0.67)	ND(0.64)	ND(0.51)	ND(0.65)	ND(0.64)	ND(0.55)
2,4'-DDT	ug/kg	ND(1.2)	4.6	1.8	ND(1.1)	ND(0.85)	ND(1.1)	ND(1.1)	ND(0.91)
4,4'-DDT	ug/kg	1.1	16	16	4.6	3.7	6.8	2.0	1.6
2,4'-DDE	ug/kg	ND(1.2)	ND(1.2)	ND(1.1)	ND(1.1)	ND(0.85)	ND(1.1)	ND(1.1)	ND(0.91)
4,4'-DDE	ug/kg	62	27	26	53	22	28	14	37
2,4'-DDD	ug/kg	ND(0.75)	ND(0.73)	7.5	ND(0.64)	ND(0.51)	ND(0.65)	ND(0.64)	17
4,4'-DDD	ug/kg	18	17	24	29	6	18	10	23

Table C-2 Analytical Data (Battelle, 2004).

Location ID:		1N	1S	2N	2S	3N	3S	4C	5N
Depth Interval (ft):		Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Sample Date:	Units:	4/20/2000	4/20/2000	4/20/2000	4/20/2000	4/20/2000	4/20/2000	4/19/2000	4/19/2000
C1-Fluoranthenes/pyrenes	ug/kg	240	180	200	270	220	330	380	950
C2-Fluoranthenes/pyrenes	ug/kg	210	140	150	210	190	240	250	440
C3-Fluoranthenes/pyrenes	ug/kg	160	90	100	150	130	160	150	210
Benzo[a]anthracene	ug/kg	160	130	150	200	160	250	340	700
Chrysene	ug/kg	190	180	190	260	210	350	390	730
C1-Chrysenes	ug/kg	140	92	110	150	150	170	200	310
C2-Chrysenes	ug/kg	160	89	100	150	140	160	160	200
C3-Chrysenes	ug/kg	130	76	92	130	120	140	160	160
C4-Chrysenes	ug/kg	100	52	61	93	81	110	100	100
Benzo[b]fluoranthene	ug/kg	470	380	380	490	350	610	720	910
Benzo[k]fluoranthene	ug/kg	100	98	110	150	90	150	220	330
Benzo[e]pyrene	ug/kg	290	240	240	320	220	380	460	540
Benzo[a]pyrene	ug/kg	350	310	300	400	290	500	620	790
Perylene	ug/kg	130	120	110	150	86	170	210	240
Indeno[1,2,3,-c,d]pyrene	ug/kg	350	300	300	380	230	440	540	600
Dibenzo[a,h]anthracene	ug/kg	50	38	43	51	41	61	78	110
Benzo[g,h,i]perylene	ug/kg	410	340	340	440	260	490	590	640
Biphenyl	ug/kg	15	11	11	13	8.0	12	17	20
Total PAHs (41 compounds)	ug/kg	5,448	4,361	4,602	6,094	4,692	7,154	8,505	16,153
LMW PAHs	ug/kg	1,083	837	927	1,183	1,102	1,315	1,534	3,813
HMW PAHs	ug/kg	4,380	3,535	3,686	4,924	3,598	5,851	6,988	12,360
PESTICIDES									
Aldrin	ug/kg	ND(0.52)	ND(0.50)	ND(0.43)	ND(0.49)	0.47	ND(0.48)	ND(0.45)	ND(0.39)
alpha-Chlordane	ug/kg	22	3.3	7.0	15	6.2	5.7	5.2	6.4
gamma-Chlordane	ug/kg	48	8	15	32	16	13	15	17
cis-Nonachlor	ug/kg	8.3	2.7	ND(0.38)	5.8	3.2	4.0	3.4	9.4
trans-Nonachlor	ug/kg	9.8	ND(0.34)	3.6	6.3	3.1	2.9	2.4	ND(0.27)
Total Chlordane (4	ug/kg	88	14	26	59	29	26	26	33
Heptachlor	ug/kg	ND(0.49)	ND(0.47)	ND(0.40)	ND(0.46)	ND(0.30)	ND(0.45)	ND(0.42)	ND(0.36)
Heptachlor Epoxide	ug/kg	ND(0.49)	ND(0.47)	ND(0.40)	ND(0.46)	ND(0.30)	ND(0.45)	ND(0.42)	ND(0.36)
2,4'-DDT	ug/kg	ND(0.81)	ND(0.78)	ND(0.68)	ND(0.77)	ND(0.51)	ND(0.75)	ND(0.70)	ND(0.61)
4,4'-DDT	ug/kg	ND(1.1)	ND(1.1)	ND(0.94)	1.9	2.9	3.5	3.0	2.1
2,4'-DDE	ug/kg	ND(0.81)	ND(0.78)	ND(0.68)	ND(0.77)	ND(0.51)	ND(0.75)	ND(0.70)	ND(0.61)
4,4'-DDE	ug/kg	73	17	30	50	22	18	24	31
2,4'-DDD	ug/kg	ND(0.49)	ND(0.47)	4.1	5.6	6.8	4.6	6.3	56
4,4'-DDD	ug/kg	19	8	14	18	14	12	12	22

Table C-2 Analytical Data (Battelle, 2004).

Location ID:		1N	1S	2N	2S	3N	3S	4C	5N
Depth Interval (ft):		Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Sample Date:	Units:	10/14/1999	10/14/1999	10/14/1999	10/14/1999	10/13/1999	10/13/1999	10/13/1999	10/13/1999
Total DDT (6 compounds)	ug/kg	81	65	75	87	32	53	26	79
Dieldrin	ug/kg	16	10	6.2	22	20	12	6.3	19
Endrin	ug/kg	ND(0.75)	ND(0.73)	ND(0.67)	ND(0.64)	ND(0.51)	ND(0.65)	ND(0.64)	ND(0.55)
alpha-hexachlorocyclohexane	ug/kg	0.03	0.04	ND(0.58)	0.02	0.28	0.03	0.01	0.03
beta-hexachlorocyclohexane	ug/kg	ND(0.32)	ND(0.32)	ND(0.29)	ND(0.28)	ND(0.22)	ND(0.28)	ND(0.28)	ND(0.24)
delta-hexachlorocyclohexane	ug/kg	ND(0.52)	ND(0.51)	ND(0.47)	ND(0.44)	ND(0.36)	ND(0.46)	ND(0.45)	ND(0.38)
Lindane	ug/kg	0.61	0.09	0.14	0.29	ND(0.38)	0.22	0.13	0.24
Mirex	ug/kg	ND(0.37)	ND(0.36)	ND(0.34)	ND(0.32)	ND(0.26)	ND(0.33)	ND(0.32)	ND(0.27)
POLYCHLORINATED BIPHENYLS (PCBs) - Congener Method									
PCB-8	ug/kg	2.8	2.0	1.6	2.1	2.1	2.7	2.0	2.6
PCB-18	ug/kg	1.3	1.2	0.7	4.8	1.0	1.8	1.2	1.5
BCB-28	ug/kg	3.5	3.1	2.0	11	2.2	3.6	2.6	3.2
PCB-44	ug/kg	13	7.3	6.4	50	7.4	11	6.1	12
PCB-52	ug/kg	17	10	8.0	66	9.2	12	8.2	17
PCB-66	ug/kg	39	25	20	150	20	28	20	33
PCB-77	ug/kg	27	18	14	33	14	19	15	22
PCB-101	ug/kg	62	36	30	150	28	35	25	50
PCB-105	ug/kg	23	13	12	58	8.0	11	7.8	13
PCB-118	ug/kg	60	33	28	150	23	28	20	33
PCB-126	ug/kg	ND(0.92)	ND(0.90)	ND(0.83)	ND(0.78)	ND(0.63)	ND(0.80)	ND(0.79)	ND(0.67)
PCB-128	ug/kg	23	14	11	37	11	17	13	15
PCB-138	ug/kg	130	65	55	170	50	70	48	85
PCB-153	ug/kg	170	80	70	210	82	110	61	140
PCB-170	ug/kg	41	25	21	44	21	30	21	38
PCB-180	ug/kg	69	44	36	73	39	56	38	69
PCB-187	ug/kg	46	31	25	44	27	35	25	52
PCB-195	ug/kg	7.2	4.6	3.7	7.4	4.1	5.3	3.6	7.5
PCB-206	ug/kg	4.9	3.4	2.3	5.6	2.7	4.2	2.7	4.8
PCB-209	ug/kg	3.2	2.4	2.5	2.8	1.3	1.9	1.4	1.9
Total PCBs (18 congeners)	ug/kg	716	400	335	1,236	339	463	307	579
Total PCBs (20 congeners)	ug/kg	743	418	349	1,269	353	482	322	601

Table C-2 Analytical Data (Battelle, 2004).

Location ID:		1N	1S	2N	2S	3N	3S	4C	5N
Depth Interval (ft):		Surface	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Sample Date:	Units:	4/20/2000	4/20/2000	4/20/2000	4/20/2000	4/20/2000	4/20/2000	4/19/2000	4/19/2000
Total DDT (6 compounds)	ug/kg	92	25	48	18	14	12	12	22
Dieldrin	ug/kg	14	3.5	5.2	12	10	5.5	8.5	13
Endrin	ug/kg	ND(0.49)	ND(0.47)	ND(0.40)	ND(0.46)	ND(0.30)	ND(0.45)	ND(0.42)	ND(0.36)
alpha-hexachlorocyclohexane	ug/kg	ND(0.42)	ND(0.41)	ND(0.35)	ND(0.40)	ND(0.26)	ND(0.39)	ND(0.36)	ND(0.32)
beta-hexachlorocyclohexane	ug/kg	ND(0.21)	ND(0.20)	ND(0.18)	ND(0.20)	ND(0.13)	ND(0.20)	ND(0.18)	ND(0.16)
delta-hexachlorocyclohexane	ug/kg	ND(0.34)	ND(0.33)	ND(0.28)	ND(0.32)	ND(0.21)	ND(0.32)	ND(0.29)	ND(0.26)
Lindane	ug/kg	ND(0.36)	ND(0.34)	ND(0.30)	ND(0.34)	ND(0.22)	ND(0.33)	ND(0.31)	ND(0.27)
Mirex	ug/kg	ND(0.24)	ND(0.23)	ND(0.20)	ND(0.23)	ND(0.15)	ND(0.20)	ND(0.21)	ND(0.18)
POLYCHLORINATED BIPHENYLS (PCBs) - Congener Method									
PCB-8	ug/kg	1.8	1.7	1.2	1.9	1.6	1.8	1.6	3.0
PCB-18	ug/kg	1.1	1.1	ND(0.82)	1.8	1.1	1.5	1.2	2.3
BCB-28	ug/kg	3.0	2.3	1.9	3.3	1.8	2.8	2.7	3.3
PCB-44	ug/kg	15	4.5	5.1	8.0	4.3	5.0	4.6	8.9
PCB-52	ug/kg	19	6.7	9.1	16	10	9.7	9.2	21
PCB-66	ug/kg	39	16	22	ND(0.49)	ND(0.32)	ND(0.48)	20	ND(0.39)
PCB-77	ug/kg	ND(0.81)	ND(0.78)	ND(0.68)	ND(0.77)	ND(0.51)	ND(0.75)	ND(0.70)	ND(0.61)
PCB-101	ug/kg	67	23	35	53	30	34	31	150
PCB-105	ug/kg	14	ND(0.61)	ND(0.53)	8	ND(0.40)	ND(0.59)	ND(0.55)	ND(0.48)
PCB-118	ug/kg	71	21	35	48	25	25	23	48
PCB-126	ug/kg	ND(0.64)	ND(0.61)	ND(0.53)	ND(0.60)	ND(0.40)	ND(0.59)	ND(0.55)	ND(0.48)
PCB-128	ug/kg	21	7.2	11	15	7.7	8.4	8.7	13
PCB-138	ug/kg	150	48	85	110	51	65	62	170
PCB-153	ug/kg	120	42	60	94	48	59	60	490
PCB-170	ug/kg	50	20	29	41	20	29	27	50
PCB-180	ug/kg	86	33	49	67	37	54	50	120
PCB-187	ug/kg	54	23	33	42	27	35	35	210
PCB-195	ug/kg	8.9	3.4	5.1	6.5	3.7	5.1	5.6	15
PCB-206	ug/kg	5.4	2.2	3.3	4.6	2.4	3.0	4.5	11
PCB-209	ug/kg	3.3	1.6	3.0	3.3	1.4	1.9	6.2	1.8
Total PCBs (18 congeners)	ug/kg	730	257	388	524	271	341	352	1,317
Total PCBs (20 congeners)	ug/kg	730	257	388	524	271	341	352	1,317

Notes:

1. Reference: Batelle. 2004. Sediment Investigation at Yosemite Creek. Prepared for San Francisco Public Utilities Commission Planning Bureau. May 2004.
2. ND(0.09) - compound not detected. Value in parentheses represents the reported detection limit.
3. J - detected result was between the method reporting limit and the reported detection limit.

Table C-3 Analytical Data (E&E, 2009).

Location ID:		YC-001	YC-001	YC-001	YC-001	YC-002	YC-002	YC-002	YC-002	YC-002	YC-003
Depth Interval (ft):		0 - 1	1 - 2	2 - 3	3 - 4	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	0 - 1
Sample Date:	Units:	7/1/2009	7/1/2009	7/1/2009	7/1/2009	7/1/2009	7/1/2009	7/1/2009	7/1/2009	7/1/2009	6/29/2009
METALS											
Chromium	mg/kg	36.9 J	30.9 J	66.9 J	98.9 J	182 J	796 J	52.0 J	58.6 J	55.1 J	318 J
Lead	mg/kg	20.5 J	15.9 J	24.0 J	124 J	269 J	746 J	36.9 J	26.7 J	8.0 J	891 J
Mercury	mg/kg	0.052 J	0.073	0.044	0.5	1.2	1.4	0.2	0.25	0.12	0.29
Zinc	mg/kg	40.2	38.0 J	83.8 J	167 J	407 J	730 J	70.3 J	71.3 J	43.4 J	394 J
TOTAL PETROLEUM HYDROCARBONS											
Bunker C	mg/kg	ND(4.9)	ND(4.9)	ND(6.3)	ND(7.2)	ND(7.9)	ND(59)	ND(4.4)	ND(5.2)	ND(4.9)	ND(100)
Diesel Fuel	mg/kg	ND(0.89)	ND(0.89)	ND(1.1)	ND(1.3)	140 J	640 J	32 J	16 J	ND(0.89)	680 J
Fuel Oil 4 & 5	mg/kg	ND(4.9)	ND(4.9)	ND(6.3)	ND(7.2)	ND(7.9)	ND(59)	ND(4.4)	ND(5.2)	ND(4.9)	ND(100)
Hydraulc Fluid	mg/kg	ND(4.9)	ND(4.9)	ND(6.3)	ND(7.2)	ND(7.9)	ND(59)	ND(4.4)	ND(5.2)	ND(4.9)	ND(100)
Jet A	mg/kg	ND(5.0)	ND(5.0)	ND(6.3)	ND(7.2)	ND(7.9)	ND(59)	ND(4.4)	ND(5.2)	ND(5.0)	ND(100)
JP4	mg/kg	ND(4.9)	ND(4.9)	ND(6.3)	ND(7.2)	ND(7.9)	ND(59)	ND(4.4)	ND(5.2)	ND(4.9)	ND(100)
JP5	mg/kg	ND(4.9)	ND(4.9)	ND(6.3)	ND(7.2)	ND(7.9)	ND(59)	ND(4.4)	ND(5.2)	ND(4.9)	ND(100)
JP8	mg/kg	ND(4.9)	ND(4.9)	ND(6.3)	ND(7.2)	ND(7.9)	ND(59)	ND(4.4)	ND(5.2)	ND(4.9)	ND(100)
Kerosene	mg/kg	ND(4.9)	ND(4.9)	ND(6.3)	ND(7.2)	ND(7.9)	ND(59)	ND(4.4)	ND(5.2)	ND(4.9)	ND(100)
Mineral Spirits	mg/kg	ND(4.9)	ND(4.9)	ND(6.3)	ND(7.2)	ND(7.9)	ND(59)	ND(4.4)	ND(5.2)	ND(4.9)	ND(100)
Motor Oil	mg/kg	ND(5.2)	ND(5.2)	ND(6.7)	ND(7.6)	430 J	850 J	79 J	27 J	ND(5.2)	1700 J
Gasoline	ug/kg	ND(510)	ND(440)	ND(650)	ND(740)	ND(810)	ND(600)	460	ND(530)	ND(510)	ND(520)
PESTICIDES											
4,4'-DDE	ug/kg	ND(2.4)	ND(2.1)	ND(3.0)	ND(70)	ND(95)	ND(570)	ND(53)	ND(2.5)	ND(2.4)	ND(730)
4,4'-DDT	ug/kg	ND(3.3)	ND(2.8)	ND(4.2)	ND(4.8)	ND(5.2)	ND(780)	ND(2.9)	ND(3.5)	ND(3.3)	ND(1,000)
4,4'-TDE/DDD	ug/kg	ND(2.7)	ND(2.3)	ND(3.4)	ND(3.9)	ND(4.3)	ND(3.2)	ND(2.4)	ND(2.8)	ND(2.7)	ND(2.7)
alpha-Chlordane	ug/kg	ND(3.1)	ND(2.7)	ND(4.0)	ND(4.6)	ND(5.0)	ND(750)	ND(2.8)	ND(3.3)	ND(3.1)	ND(950)
Dieldrin	ug/kg	ND(1.6)	ND(1.4)	ND(2.1)	ND(48)	ND(65)	ND(390)	ND(36)	ND(1.7)	ND(1.6)	ND(500)
gamma-Chlordane	ug/kg	ND(3.1)	ND(2.7)	ND(4.0)	NA	ND(5.0)	ND(750)	ND(2.8)	ND(3.3)	ND(3.1)	ND(950)
POLYCHLORINATED BIPHENYLS (PCBs) - Congener Method											
PCB-8	ug/Kg	ND(0.07)	ND(0.06)	ND(0.10)	46	ND(0.12)	ND(0.09)	ND(0.07)	ND(0.08)	ND(0.07)	5.8
PCB-18	ug/Kg	ND(0.06)	ND(0.05)	ND(0.08)	ND(0.09)	ND(0.10)	ND(0.07)	ND(0.05)	ND(0.06)	ND(0.06)	ND(0.06)
PCB-28	ug/Kg	ND(0.03)	ND(0.03)	ND(0.04)	ND(0.04)	ND(0.05)	ND(0.04)	ND(0.03)	ND(0.03)	ND(0.03)	ND(0.03)
PCB-44	ug/Kg	ND(0.01)	ND(0.01)	ND(0.02)	ND(0.02)	ND(0.02)	44 J	1.9 J	ND(0.02)	ND(0.01)	29 J
PCB-52	ug/Kg	ND(0.01)	ND(0.01)	ND(0.02)	ND(0.02)	ND(0.02)	230 J	4.5 J	1.4 J	ND(0.01)	93 J
PCB-66	ug/Kg	ND(0.01)	ND(0.01)	ND(0.02)	ND(0.02)	ND(0.02)	450 J	9.6 J	ND(0.02)	ND(0.01)	33 J
PCB-77	ug/Kg	ND(0.09)	ND(0.08)	ND(0.11)	ND(0.13)	ND(0.14)	1200	2.8	ND(0.09)	ND(0.09)	62
PCB-81	ug/Kg	ND(0.09)	ND(0.08)	0.64 J	ND(0.13)	7.6 J	ND(0.11)	7.5 J	ND(0.09)	ND(0.09)	27 J
PCB-101	ug/Kg	1.1 J	ND(0.01)	ND(0.02)	ND(0.02)	7.1 J	610 J	17 J	2.2 J	ND(0.01)	200 J
PCB-105	ug/Kg	ND(0.01)	ND(0.01)	ND(0.02)	ND(0.02)	ND(0.02)	160 J	6.6 J	ND(0.02)	ND(0.01)	44 J
PCB-114	ug/Kg	ND(0.01)	ND(0.01)	ND(0.02)	ND(0.02)	ND(0.02)	ND(0.02)	ND(0.01)	2.8	ND(0.01)	ND(0.01)

Table C-3 Analytical Data (E&E, 2009).

Location ID: Depth Interval (ft): Sample Date:	Units:	YC-003 1 - 2 6/29/2009	YC-003 2 - 3 6/29/2009	YC-003 3 - 4 6/29/2009	YC-003 4 - 5 6/29/2009	YC-004 0 - 1 7/2/2009	YC-004 1 - 2 7/2/2009	YC-004 2 - 3 7/2/2009	YC-005 0 - 1 7/7/2009	YC-005 1 - 2 7/7/2009	YC-005 2 - 3 7/7/2009
METALS											
Chromium	mg/kg	82.8 J	47.1 J	29.4 J	68.4 J	145 J	249 J	39.6 J	165 J	219 J	43.5 J
Lead	mg/kg	156 J	26.0 J	8.2 J	8.3 J	203 J	584 J	14.7 J	439 J	563 J	28.6 J
Mercury	mg/kg	ND(0.04)	0.057	0.048	ND(0.04)	0.37 J	0.97 J	0.13 J	0.26 J	0.31 J	0.40 J
Zinc	mg/kg	198 J	67.4 J	31.5 J	65.1 J	286 J	762 J	40.2 J	378 J	474 J	54.1 J
TOTAL PETROLEUM HYDROCARBONS											
Bunker C	mg/kg	ND(6.5)	ND(5.0)	ND(4.2)	ND(6.1)	ND(44)	ND(140)	ND(4.4)	ND(96)	ND(520)	ND(42)
Diesel Fuel	mg/kg	ND(1.2)	ND(0.92)	ND(0.76)	ND(1.1)	640	1100	ND(0.80)	340 J	1100 J	96 J
Fuel Oil 4 & 5	mg/kg	ND(6.5)	ND(5.0)	ND(4.2)	ND(6.1)	ND(44)	ND(140)	ND(4.4)	ND(96)	ND(520)	ND(42)
Hydraulc Fluid	mg/kg	ND(6.5)	ND(5.0)	ND(4.2)	ND(6.1)	ND(44)	ND(140)	ND(4.4)	ND(96)	ND(520)	ND(42)
Jet A	mg/kg	ND(6.5)	ND(5.1)	ND(4.2)	ND(6.2)	ND(45)	ND(140)	ND(4.5)	ND(97)	ND(520)	ND(43)
JP4	mg/kg	ND(6.5)	ND(5.0)	ND(4.2)	ND(6.1)	ND(44)	ND(140)	ND(4.4)	ND(96)	ND(520)	ND(42)
JP5	mg/kg	ND(6.5)	ND(5.0)	ND(4.2)	ND(6.1)	ND(44)	ND(140)	ND(4.4)	ND(96)	ND(520)	ND(42)
JP8	mg/kg	ND(6.5)	ND(5.0)	ND(4.2)	ND(6.1)	ND(44)	ND(140)	ND(4.4)	ND(96)	ND(520)	ND(42)
Kerosene	mg/kg	ND(6.5)	ND(5.0)	ND(4.2)	ND(6.1)	ND(44)	ND(140)	ND(4.4)	ND(96)	ND(520)	ND(42)
Mineral Spirits	mg/kg	ND(6.5)	ND(5.0)	ND(4.2)	ND(6.1)	ND(44)	ND(140)	ND(4.4)	ND(96)	ND(520)	ND(42)
Motor Oil	mg/kg	ND(6.8)	ND(5.4)	ND(4.4)	ND(6.5)	2400	3000	ND(4.7)	1100 J	3400 J	280 J
Gasoline	ug/kg	ND(670)	ND(520)	ND(430)	ND(630)	ND(910)	5600 J	ND(460)	ND(500)	3900 J	2200 J
PESTICIDES											
4,4'-DDE	ug/kg	ND(63)	ND(2.4)	ND(2.0)	ND(3.0)	ND(210)	ND(690)	ND(43)	ND(930)	ND(2,500)	ND(100)
4,4'-DDT	ug/kg	ND(4.3)	ND(3.4)	ND(2.8)	ND(4.1)	ND(5.9)	ND(4.7)	ND(2.9)	ND(3.2)	ND(3.4)	ND(2.8)
4,4'-TDE/DDD	ug/kg	ND(3.5)	ND(2.8)	ND(2.3)	ND(3.3)	ND(4.8)	ND(3.9)	ND(2.4)	ND(2.6)	ND(2.8)	ND(2.3)
alpha-Chlordane	ug/kg	ND(4.1)	ND(3.2)	ND(2.6)	ND(3.9)	ND(280)	ND(900)	ND(2.8)	ND(1,200)	ND(3,300)	ND(130)
Dieldrin	ug/kg	ND(43)	ND(1.7)	ND(1.4)	ND(2.0)	ND(150)	ND(470)	ND(1.5)	ND(640)	ND(1,700)	ND(71)
gamma-Chlordane	ug/kg	ND(4.1)	ND(3.2)	ND(2.6)	ND(3.9)	ND(280)	ND(900)	ND(2.8)	ND(1,200)	ND(3,300)	ND(130)
POLYCHLORINATED BIPHENYLS (PCBs) - Congener Method											
PCB-8	ug/Kg	ND(0.10)	ND(0.08)	ND(0.06)	ND(0.09)	ND(0.13)	10	ND(0.07)	ND(0.73)	ND(1.6)	ND(0.06)
PCB-18	ug/Kg	1.8 J	ND(0.06)	ND(0.05)	ND(0.07)	ND(0.11)	ND(0.09)	ND(0.05)	ND(0.58)	ND(1.3)	ND(0.05)
PCB-28	ug/Kg	ND(0.04)	ND(0.03)	ND(0.03)	ND(0.04)	2.2	ND(0.04)	ND(0.03)	27 J	49 J	1.1 J
PCB-44	ug/Kg	2.2 J	ND(0.01)	ND(0.01)	ND(0.02)	3.5 J	53 J	ND(0.01)	140 J	310 J	7.1 J
PCB-52	ug/Kg	4.9 J	ND(0.01)	ND(0.01)	ND(0.02)	9.6 J	240 J	1.3 J	320 J	720 J	17 J
PCB-66	ug/Kg	8.6 J	ND(0.01)	ND(0.01)	ND(0.02)	15 J	380 J	ND(0.01)	410 J	920 J	23 J
PCB-77	ug/Kg	ND(0.12)	ND(0.09)	ND(0.08)	ND(0.11)	ND(0.16)	ND(0.13)	ND(0.08)	ND(0.88)	ND(1.9)	ND(0.08)
PCB-81	ug/Kg	2.2 J	ND(0.09)	ND(0.08)	ND(0.11)	ND(0.16)	ND(0.13)	ND(0.08)	ND(0.88)	ND(1.9)	ND(0.08)
PCB-101	ug/Kg	16 J	ND(0.01)	ND(0.01)	ND(0.02)	34 J	730 J	3.9 J	640 J	1500 J	35 J
PCB-105	ug/Kg	3.1 J	ND(0.01)	ND(0.01)	ND(0.02)	12 J	280 J	1.5 J	210	500	12
PCB-114	ug/Kg	9.2	ND(0.01)	ND(0.01)	ND(0.02)	ND(0.03)	ND(0.02)	ND(0.01)	ND(0.15)	ND(0.31)	ND(0.01)

Table C-3 Analytical Data (E&E, 2009).

Location ID:		YC-005	YC-005	YC-006	YC-006	YC-006	YC-006	YC-006	YC-007	YC-007	YC-007
Depth Interval (ft):		3 - 4	4 - 5	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	0 - 1	1 - 2	2 - 3
Sample Date:	Units:	7/7/2009	7/7/2009	6/29/2009	6/29/2009	6/29/2009	6/29/2009	6/29/2009	7/7/2009	7/7/2009	7/7/2009
METALS											
Chromium	mg/kg	58.5 J	58.7 J	125 J	134 J	50.1 J	39.8 J	38.1 J	291 J	79.4 J	47.7 J
Lead	mg/kg	8.5 J	5.4 J	161 J	175 J	67.1 J	16.2 J	4.1 J	724 J	102 J	21.7 J
Mercury	mg/kg	0.088 J	ND(0.03)	0.71 J	0.49 J	0.28 J	0.078 J	0.037 J	1.0 J	0.16 J	0.047 J
Zinc	mg/kg	42.1 J	52.0 J	242 J	251 J	77.6 J	47.5 J	42.3 J	500 J	114 J	54.9 J
TOTAL PETROLEUM HYDROCARBONS											
Bunker C	mg/kg	ND(4.7)	ND(5.4)	ND(7.80	ND(6.2)	ND(4.6)	ND(4.2)	ND(4.1)	ND(690)	ND(4.4) U J	ND(4.6) U J
Diesel Fuel	mg/kg	26 J	ND(0.99)	15 J	51 J	10 J	ND(0.76)	ND(0.74)	400 J	82 J	13 J
Fuel Oil 4 & 5	mg/kg	ND(4.7)	ND(5.4)	ND(7.80	ND(6.2)	ND(4.6)	ND(4.2)	ND(4.1)	ND(690)	ND(4.4) U J	ND(4.6) U J
Hydraulc Fluid	mg/kg	ND(4.7)	ND(5.4)	ND(7.80	ND(6.2)	ND(4.6)	ND(4.2)	ND(4.1)	ND(690)	ND(4.4) U J	ND(4.6) U J
Jet A	mg/kg	ND(4.7)	ND(5.5)	ND(7.9)	ND(6.3)	ND(4.7)	ND(4.2)	ND(4.1)	ND(700)	ND(4.5) U J	ND(4.6) U J
JP4	mg/kg	ND(4.7)	ND(5.4)	ND(7.80	ND(6.2)	ND(4.6)	ND(4.2)	ND(4.1)	ND(690)	ND(4.4) U J	ND(4.6) U J
JP5	mg/kg	ND(4.7)	ND(5.4)	ND(7.80	ND(6.2)	ND(4.6)	ND(4.2)	ND(4.1)	ND(690)	ND(4.4) U J	ND(4.6) U J
JP8	mg/kg	ND(4.7)	ND(5.4)	ND(7.80	ND(6.2)	ND(4.6)	ND(4.2)	ND(4.1)	ND(690)	ND(4.4) U J	ND(4.6) U J
Kerosene	mg/kg	ND(4.7)	ND(5.4)	ND(7.80	ND(6.2)	ND(4.6)	ND(4.2)	ND(4.1)	ND(690)	ND(4.4) U J	ND(4.6) U J
Mineral Spirits	mg/kg	ND(4.7)	ND(5.4)	ND(7.80	ND(6.2)	ND(4.6)	ND(4.2)	ND(4.1)	ND(690)	ND(4.4) U J	ND(4.6) U J
Motor Oil	mg/kg	47 J	ND(5.8)	54 J	160 J	26 J	ND(4.4)	ND(4.3)	1800 J	350 J	28 J
Gasoline	ug/kg	ND(480)	ND(560)	ND(810)	ND(640)	ND(480)	ND(430)	ND(420)	ND(710)	ND(460)	ND(470)
PESTICIDES											
4,4'-DDE	ug/kg	ND(2.3)	ND(2.6)	ND(3.8)	ND(300)	ND(2.3)	ND(2.0)	ND(2.0)	ND(1,300)	ND(220)	ND(44)
4,4'-DDT	ug/kg	ND(3.1)	ND(3.6)	ND(5.2)	ND(420)	ND(3.1)	ND(2.8)	ND(2.7)	ND(4.6)	ND(3.0)	ND(3.0)
4,4'-TDE/DDD	ug/kg	ND(2.5)	ND(3.0)	ND(4.3)	ND(3.4)	ND(2.5)	ND(2.3)	ND(2.2)	ND(3.8)	ND(2.4)	ND(2.5)
alpha-Chlordane	ug/kg	ND(3.0)	ND(3.5)	ND(5.0)	ND(4.0)	ND(3.0)	ND(2.6)	ND(2.6)	ND(1,800)	ND(280)	ND(2.9)
Dieldrin	ug/kg	ND(1.6)	ND(1.8)	ND(2.6)	ND(210)	ND(1.5)	ND(1.4)	ND(1.4)	ND(920)	ND(150)	ND(30)
gamma-Chlordane	ug/kg	ND(3.0)	ND(3.5)	ND(5.0)	ND(400)	ND(3.0)	ND(2.6)	ND(2.6)	ND(1,800)	ND(2.8)	ND(2.9)
POLYCHLORINATED BIPHENYLS (PCBs) - Congener Method											
PCB-8	ug/Kg	ND(0.07)	ND(0.08)	ND(0.12)	2.8	ND(0.07)	ND(0.06)	ND(0.06)	ND(10)	ND(1.3)	ND(0.07)
PCB-18	ug/Kg	ND(0.06)	ND(0.07)	ND(0.10)	16	ND(0.06)	ND(0.05)	ND(0.05)	ND(8.4)	ND(1.1)	ND(0.06)
PCB-28	ug/Kg	ND(0.03)	ND(0.03)	ND(0.05)	3.8 J	ND(0.03)	ND(0.03)	ND(0.03)	ND(4.2)	ND(0.54)	0.97 J
PCB-44	ug/Kg	ND(0.01)	ND(0.02)	ND(0.02)	20 J	1.7 J	1.0 J	ND(0.01)	250 J	ND(0.27)	ND(0.01)
PCB-52	ug/Kg	ND(0.01)	ND(0.02)	3.6 J	48 J	4.2 J	2.9 J	ND(0.01)	670 J	41 J	3.1 J
PCB-66	ug/Kg	ND(0.01)	ND(0.02)	7.3 J	120 J	8.4 J	6.1 J	ND(0.01)	800 J	21 J	2.4 J
PCB-77	ug/Kg	ND(0.09)	ND(0.10)	ND(0.14)	ND(0.11)	ND(0.08)	ND(0.08)	ND(0.07)	ND(13)	ND(1.6)	ND(0.08)
PCB-81	ug/Kg	ND(0.09)	ND(0.10)	ND(0.14)	ND(0.11)	ND(0.08)	ND(0.08)	ND(0.07)	ND(13)	ND(1.6)	ND(0.08)
PCB-101	ug/Kg	ND(0.01)	ND(0.02)	12 J	180 J	16 J	10 J	1.1 J	1200 J	39 J	3.7 J
PCB-105	ug/Kg	ND(0.01)	ND(0.02)	3.7 J	36 J	5.5 J	1.9 J	ND(0.01)	230	ND(0.27)	0.63 J
PCB-114	ug/Kg	ND(0.01)	ND(0.02)	ND(0.02)	ND(0.02)	ND(0.01)	ND(0.01)	ND(0.01)	840 J	64 J	3.7 J

Table C-3 Analytical Data (E&E, 2009).

Location ID:		YC-007	YC-007	YC-008	YC-008	YC-008	YC-008	YC-008	YC-009	YC-009	YC-009
Depth Interval (ft):		3 - 4	4 - 5	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	0 - 1	1 - 2	2 - 3
Sample Date:	Units:	7/7/2009	7/7/2009	7/2/2009	7/2/2009	7/2/2009	7/2/2009	7/2/2009	6/25/2009	6/25/2009	6/25/2009
METALS											
Chromium	mg/kg	35.3 J	25.1 J	99.8 J	462 J	411 J	268 J	119 J	112 J	111 J	46.0 J
Lead	mg/kg	5.5 J	3.2 J	139 J	702 J	587 J	658 J	309 J	137 J	191 J	36.9 J
Mercury	mg/kg	0.083 J	ND(0.02)	0.23 J	1.0 J	0.67 J	0.72 J	0.92 J	0.61 J	0.51 J	0.24 J
Zinc	mg/kg	29.4 J	32.3 J	205 J	713 J	761 J	1130 J	509 J	212 J	252 J	64.5 J
TOTAL PETROLEUM HYDROCARBONS											
Bunker C	mg/kg	ND(4.0) U J	ND(3.9)	ND(29)	ND(75)	ND(69)	ND(72)	ND(52)	ND(7.4)	ND(5.6)	ND(4.4)
Diesel Fuel	mg/kg	16 J	ND(0.72)	86 J	430 J	460 J	510 J	380 J	ND(1.4)	17 J	9.0 J
Fuel Oil 4 & 5	mg/kg	ND(4.0) U J	ND(3.9)	ND(29)	ND(75)	ND(69)	ND(72)	ND(52)	ND(7.4)	ND(5.6)	ND(4.4)
Hydraulc Fluid	mg/kg	ND(4.0) U J	ND(3.9)	ND(29)	ND(75)	ND(69)	ND(72)	ND(52)	ND(7.4)	ND(5.6)	ND(4.4)
Jet A	mg/kg	ND(4.1) U J	ND(4.0)	ND(29)	ND(76)	ND(70)	ND(73)	ND(52)	ND(7.5)	ND(5.7)	ND(4.4)
JP4	mg/kg	ND(4.0) U J	ND(3.9)	ND(29)	ND(75)	ND(69)	ND(72)	ND(52)	ND(7.4)	ND(5.6)	ND(4.4)
JP5	mg/kg	ND(4.0) U J	ND(3.9)	ND(29)	ND(75)	ND(69)	ND(72)	ND(52)	ND(7.4)	ND(5.6)	ND(4.4)
JP8	mg/kg	ND(4.0) U J	ND(3.9)	ND(29)	ND(75)	ND(69)	ND(72)	ND(52)	ND(7.4)	ND(5.6)	ND(4.4)
Kerosene	mg/kg	ND(4.0) U J	ND(3.9)	ND(29)	ND(75)	ND(69)	ND(72)	ND(52)	ND(7.4)	ND(5.6)	ND(4.4)
Mineral Spirits	mg/kg	ND(4.0) U J	ND(3.9)	ND(29)	ND(75)	ND(69)	ND(72)	ND(52)	ND(7.4)	ND(5.6)	ND(4.4)
Motor Oil	mg/kg	34 J	ND(4.2)	260 J	1400 J	1200 J	1600 J	960 J	ND(7.9)	56 J	21 J
Gasoline	ug/kg	ND(420)	ND(410)	ND(600)	1100 J	18000 J	11000 J	9200 J	ND(770)	ND(580)	ND(450)
PESTICIDES											
4,4'-DDE	ug/kg	ND(2.0)	ND(1.9)	ND(140)	ND(1,800)	ND(840)	ND(700)	ND(130)	ND(3.6)	ND(2.7)	ND(2.1)
4,4'-DDT	ug/kg	ND(2.7)	ND(2.6)	ND(3.9)	ND(5.0)	ND(4.6)	ND(4.8)	ND(3.4)	ND(5.0)	ND(3.8)	ND(2.9)
4,4'-TDE/DDD	ug/kg	ND(2.2)	ND(2.1)	ND(3.2)	ND(4.1)	ND(3.8)	ND(3.9)	ND(2.8)	ND(4.1)	ND(3.1)	ND(2.4)
alpha-Chlordane	ug/kg	ND(2.6)	ND(2.5)	ND(180)	ND(2,400)	ND(1,100)	ND(920)	ND(160)	ND(4.7)	ND(110)	ND(2.8)
Dieldrin	ug/kg	ND(1.3)	ND(1.3)	ND(96)	ND(1,300)	ND(580)	ND(480)	ND(86)	ND(2.5)	ND(56)	ND(1.5)
gamma-Chlordane	ug/kg	ND(2.6)	ND(2.5)	ND(180)	ND(2,400)	ND(1,100)	ND(920)	ND(160)	ND(4.7)	ND(3.6)	ND(2.8)
POLYCHLORINATED BIPHENYLS (PCBs) - Congener Method											
PCB-8	ug/Kg	ND(0.06)	ND(0.06)	ND(0.09)	45	6.2 J	ND(0.11)	ND(0.08)	ND(0.11)	ND(0.09)	ND(0.07)
PCB-18	ug/Kg	ND(0.05)	ND(0.05)	ND(0.07)	ND(1.8)	ND(0.84)	ND(0.09)	ND(0.06)	ND(0.09)	ND(0.07)	ND(0.05)
PCB-28	ug/Kg	ND(0.02)	ND(0.02)	ND(0.04)	ND(0.91)	ND(0.42)	ND(0.04)	ND(0.03)	ND(0.04)	ND(0.03)	ND(0.03)
PCB-44	ug/Kg	ND(0.01)	ND(0.01)	2.3 J	160 J	51 J	3.4 J	1.5 J	ND(0.02)	2.7 J	ND(0.01)
PCB-52	ug/Kg	ND(0.01)	1.0 J	5.8 J	380 J	130 J	10 J	4.6 J	ND(0.02)	16 J	52 J
PCB-66	ug/Kg	ND(0.01)	ND(0.01)	11 J	700 J	260 J	15 J	7.1 J	ND(0.02)	12 J	27 J
PCB-77	ug/Kg	ND(0.07)	ND(0.07)	ND(0.11)	1400	550 J	ND(0.13)	ND(0.09)	ND(0.14)	ND(0.10)	ND(0.08)
PCB-81	ug/Kg	ND(0.07)	ND(0.07)	ND(0.11)	ND(2.7)	ND(1.3)	ND(0.13)	ND(0.09)	ND(0.14)	ND(0.10)	ND(0.08)
PCB-101	ug/Kg	1.1 J	1.2 J	25 J	1100 J	390 J	37 J	16 J	3.6 J	27 J	400 J
PCB-105	ug/Kg	ND(0.01)	ND(0.01)	9.4	430	170 J	12	6.2	ND(0.02)	2.4 J	ND(0.01)
PCB-114	ug/Kg	ND(0.01)	ND(0.01)	ND(0.02)	1000 J	ND(0.21)	ND(0.02)	7.8 J	ND(0.02)	ND(0.02)	ND(0.01)

Table C-3 Analytical Data (E&E, 2009).

Location ID: / Depth Interval (ft): / Sample Date:	Units:	YC-009 3 - 4 6/25/2009	YC-009 4 - 5 6/25/2009	YC-010 0 - 1 7/9/2009	YC-010 1 - 2 7/9/2009	YC-010 2 - 3 7/9/2009	YC-010 3 - 4 7/9/2009	YC-011 0 - 1 6/25/2009	YC-011 1 - 2 6/25/2009	YC-011 2 - 3 6/25/2009	YC-011 3 - 4 6/25/2009
METALS											
Chromium	mg/kg	37.3 J	63.0 J	534 J	73.6 J	45.3 J	18.4 J	109 J	274 J	328 J	46.3 J
Lead	mg/kg	9.2 J	77.0 J	1000 J	191 J	20.8 J	1.6 J	178 J	814 J	915 J	54.9 J
Mercury	mg/kg	0.10 J	0.58 J	0.96 J	0.25 J	0.22 J	0.062 J	0.83 J	1.5 J	0.83 J	0.21 J
Zinc	mg/kg	34.2 J	126 J	759 J	177 J	62.5 J	21.1 J	239 J	666 J	1490 J	81.1 J
TOTAL PETROLEUM HYDROCARBONS											
Bunker C	mg/kg	ND(4.0)	ND(5.2)	ND(130)	ND(44)	ND(4.4)	ND(4.0)	ND(6.7)	ND(32)	ND(630)	ND(4.3)
Diesel Fuel	mg/kg	ND(0.72)	10 J	970	46	35	ND(0.73)	67 J	96 J	5900 J	26 J
Fuel Oil 4 & 5	mg/kg	ND(4.0)	ND(5.2)	ND(130)	ND(44)	ND(4.4)	ND(4.0)	ND(6.7)	ND(32)	ND(630)	ND(4.3)
Hydraulc Fluid	mg/kg	ND(4.0)	ND(5.2)	ND(130)	ND(44)	ND(4.4)	ND(4.0)	ND(6.7)	ND(32)	ND(630)	ND(4.3)
Jet A	mg/kg	ND(4.0)	ND(5.2)	ND(130)	ND(45)	ND(4.5)	ND(4.1)	ND(6.8)	ND(32)	ND(630)	ND(4.3)
JP4	mg/kg	ND(4.0)	ND(5.2)	ND(130)	ND(44)	ND(4.4)	ND(4.0)	ND(6.7)	ND(32)	ND(630)	ND(4.3)
JP5	mg/kg	ND(4.0)	ND(5.2)	ND(130)	ND(44)	ND(4.4)	ND(4.0)	ND(6.7)	ND(32)	ND(630)	ND(4.3)
JP8	mg/kg	ND(4.0)	ND(5.2)	ND(130)	ND(44)	ND(4.4)	ND(4.0)	ND(6.7)	ND(32)	ND(630)	ND(4.3)
Kerosene	mg/kg	ND(4.0)	ND(5.2)	ND(130)	ND(44)	ND(4.4)	ND(4.0)	ND(6.7)	ND(32)	ND(630)	ND(4.3)
Mineral Spirits	mg/kg	ND(4.0)	ND(5.2)	ND(130)	ND(44)	ND(4.4)	ND(4.0)	ND(6.7)	ND(32)	ND(630)	ND(4.3)
Motor Oil	mg/kg	ND(4.2)	25 J	3100	240	66	ND(4.3)	130 J	190 J	ND(660)	ND(4.6)
Gasoline	ug/kg	ND(410)	ND(530)	ND(680)	ND(460)	ND(460)	ND(410)	ND(690)	1100	23000 J	ND(440)
PESTICIDES											
4,4'-DDE	ug/kg	ND(1.9)	ND(100)	ND(3,800)	ND(260	ND(2.2)	ND(1.9)	ND(97)	ND(310)	ND(1,800)	ND(2.1)
4,4'-DDT	ug/kg	ND(2.6)	ND(140)	ND(44)	ND(2.9)	ND(3.0)	ND(2.7)	ND(130)	ND(420)	ND(2,500)	ND(2.9)
4,4'-TDE/DDD	ug/kg	ND(2.2)	ND(2.8)	ND(36)	ND(2.4)	ND(2.4)	ND(2.2)	ND(3.7)	ND(3.5)	ND(34)	ND(2.3)
alpha-Chlordane	ug/kg	ND(2.5)	ND(130)	ND(5,000)	ND(340)	ND(2.8)	ND(2.6)	ND(4.3)	ND(400)	ND(40)	ND(2.7)
Dieldrin	ug/kg	ND(1.3)	ND(69)	ND(2,600)	ND(180)	ND(1.5)	ND(1.3)	ND(67)	ND(210)	ND(1,300)	ND(1.4)
gamma-Chlordane	ug/kg	ND(2.5)	ND(3.3)	ND(5,000)	ND(340)	ND(2.8)	ND(2.6)	ND(130)	ND(400)	ND(40)	ND(2.7)
POLYCHLORINATED BIPHENYLS (PCBs) - Congener Method											
PCB-8	ug/Kg	ND(0.06)	ND(0.08)	92 J	1.8	ND(0.07)	ND(0.06)	ND(0.10)	5.4 J	ND(0.10)	ND(0.07)
PCB-18	ug/Kg	ND(0.05)	ND(0.06)	ND(8.0)	ND(0.05)	ND(0.05)	ND(0.05)	7.3	40	ND(0.08)	1.3
PCB-28	ug/Kg	ND(0.02)	ND(0.03)	ND(4.0)	ND(0.03)	ND(0.03)	ND(0.02)	ND(0.04)	4.4 J	11 J	0.28 J
PCB-44	ug/Kg	ND(0.01)	ND(0.02)	350 J	5.9 J	ND(0.01)	ND(0.01)	2.5 J	19 J	56 J	1.3 J
PCB-52	ug/Kg	ND(0.01)	4.6 J	1200 J	29 J	1.1 J	ND(0.01)	6.0 J	60 J	220 J	3.3 J
PCB-66	ug/Kg	ND(0.01)	2.4 J	1600 J	33 J	ND(0.01)	ND(0.01)	11 J	74 J	560 J	6.5 J
PCB-77	ug/Kg	ND(0.07)	ND(0.09)	760 J	ND(0.08)	ND(0.08)	ND(0.07)	ND(0.12)	ND(0.12)	420 J	ND(0.08)
PCB-81	ug/Kg	ND(0.07)	ND(0.09)	1900	ND(0.08)	ND(0.08)	ND(0.07)	ND(0.12)	ND(0.12)	ND(0.11)	ND(0.08)
PCB-101	ug/Kg	ND(0.01)	5.5 J	2700 J	100 J	2.6 J	ND(0.01)	17 J	100 J	660 J	8.2 J
PCB-105	ug/Kg	ND(0.01)	0.79 J	750 J	ND(0.01)	ND(0.01)	ND(0.01)	5.5 J	29 J	ND(0.02)	ND(0.01)
PCB-114	ug/Kg	ND(0.01)	ND(0.02)	ND(2.0)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.02)	ND(0.02)	ND(0.02)	ND(0.01)

Table C-3 Analytical Data (E&E, 2009).

Location ID:		YC-011	YC-012	YC-012	YC-012	YC-012	YC-012	YC-013	YC-013	YC-013	YC-013
Depth Interval (ft):		4 - 5	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	0 - 1	1 - 2	2 - 3	3 - 4
Sample Date:	Units:	6/25/2009	6/25/2009	6/25/2009	6/25/2009	6/25/2009	6/25/2009	6/24/2009	6/24/2009	6/24/2009	6/24/2009
METALS											
Chromium	mg/kg	33.9 J	283 J	220 J	129 J	42.4 J	30.4 J	128 J	155 J	64.4 J	44.7 J
Lead	mg/kg	8.4 J	1130 J	290 J	440 J	23.2 J	3.4 J	267 J	619 J	195 J	26.2 J
Mercury	mg/kg	0.094 J	1.3 J	0.73 J	0.64 J	0.13 J	0.043 J	0.57 J	1.1 J	0.32 J	0.14 J
Zinc	mg/kg	29.8 J	806 J	225 J	415 J	53.8 J	32.5 J	312 J	364 J	193 J	60.1 J
TOTAL PETROLEUM HYDROCARBONS											
Bunker C	mg/kg	ND(4.1)	ND(7.0)	ND(26)	ND(9.8)	ND(4.3)	ND(4.1)	ND(5.9)	ND(26)	ND(4.0)	ND(4.3)
Diesel Fuel	mg/kg	ND(0.75)	72 J	110 J	51 J	16 J	ND(0.75)	32 J	130 J	47 J	8.5 J
Fuel Oil 4 & 5	mg/kg	ND(4.1)	ND(7.0)	ND(26)	ND(9.8)	ND(4.3)	ND(4.1)	ND(5.9)	ND(26)	ND(4.0)	ND(4.3)
Hydraulc Fluid	mg/kg	ND(4.1)	ND(7.0)	ND(26)	ND(9.8)	ND(4.3)	ND(4.1)	ND(5.9)	ND(26)	ND(4.0)	ND(4.3)
Jet A	mg/kg	ND(4.2)	ND(7.1)	ND(27)	ND(9.9)	ND(4.3)	ND(4.1)	ND(6.0)	ND(26)	ND(4.1)	ND(4.3)
JP4	mg/kg	ND(4.1)	ND(7.0)	ND(26)	ND(9.8)	ND(4.3)	ND(4.1)	ND(5.9)	ND(26)	ND(4.0)	ND(4.3)
JP5	mg/kg	ND(4.1)	ND(7.0)	ND(26)	ND(9.8)	ND(4.3)	ND(4.1)	ND(5.9)	ND(26)	ND(4.0)	ND(4.3)
JP8	mg/kg	ND(4.1)	ND(7.0)	ND(26)	ND(9.8)	ND(4.3)	ND(4.1)	ND(5.9)	ND(26)	ND(4.0)	ND(4.3)
Kerosene	mg/kg	ND(4.1)	ND(7.0)	ND(26)	ND(9.8)	ND(4.3)	ND(4.1)	ND(5.9)	ND(26)	ND(4.0)	ND(4.3)
Mineral Spirits	mg/kg	ND(4.1)	ND(7.0)	ND(26)	ND(9.8)	ND(4.3)	ND(4.1)	ND(5.9)	ND(26)	ND(4.0)	ND(4.3)
Motor Oil	mg/kg	ND(4.4)	170 J	210 J	83 J	29 J	ND(4.3)	120 J	200 J	120 J	29 J
Gasoline	ug/kg	ND(430)	ND(720)	ND(540)	ND(510)	ND(440)	ND(420)	ND(610)	ND(530)	ND(420)	ND(440)
PESTICIDES											
4,4'-DDE	ug/kg	ND(2.0)	ND(680)	ND(1,000)	ND(95)	ND(2.1)	ND(2.0)	ND(430)	ND(2,200)	ND(240)	ND(2.1)
4,4'-DDT	ug/kg	ND(2.8)	ND(940)	ND(1,400)	ND(130)	ND(2.9)	ND(2.7)	ND(590)	ND(3,100)	ND(320)	ND(2.8)
4,4'-TDE/DDD	ug/kg	ND(2.3)	ND(19)	ND(29)	ND(2.7)	ND(2.3)	ND(2.2)	ND(3.2)	ND(14)	ND(2.2)	ND(2.3)
alpha-Chlordane	ug/kg	ND(2.6)	ND(890)	ND(33)	ND(3.1)	ND(2.7)	ND(2.6)	ND(560)	ND(2,900)	ND(310)	ND(2.7)
Dieldrin	ug/kg	ND(1.4)	ND(470)	ND(18)	ND(1.6)	ND(1.4)	ND(1.4)	ND(300)	ND(1,500)	ND(160)	ND(1.4)
gamma-Chlordane	ug/kg	ND(2.6)	ND(890)	ND(1,300)	ND(3.1)	ND(2.7)	ND(2.6)	ND(560)	ND(2,900)	ND(310)	ND(2.7)
POLYCHLORINATED BIPHENYLS (PCBs) - Congener Method											
PCB-8	ug/Kg	ND(0.06)	ND(0.11)	2.1 J	ND(0.07)	ND(0.07)	ND(0.06)	3.0 J	12 J	2.5 J	ND(0.07)
PCB-18	ug/Kg	ND(0.05)	ND(0.09)	12	ND(0.06)	ND(0.05)	ND(0.05)	ND(0.07)	ND(0.06)	16	ND(0.05)
PCB-28	ug/Kg	ND(0.03)	ND(0.04)	4.9 J	ND(0.03)	ND(0.03)	ND(0.03)	ND(0.04)	ND(0.03)	ND(0.02)	ND(0.03)
PCB-44	ug/Kg	ND(0.01)	20 J	18 J	1.7 J	ND(0.01)	ND(0.01)	7.5 J	140 J	14 J	ND(0.01)
PCB-52	ug/Kg	ND(0.01)	66 J	52 J	5.2 J	ND(0.01)	ND(0.01)	17 J	380 J	320 J	2.3 J
PCB-66	ug/Kg	ND(0.01)	73 J	190 J	10 J	ND(0.01)	ND(0.01)	30 J	490 J	100 J	ND(0.01)
PCB-77	ug/Kg	ND(0.07)	ND(0.13)	ND(0.10)	ND(0.09)	ND(0.08)	ND(0.07)	ND(0.11)	ND(0.09)	ND(0.07)	ND(0.08)
PCB-81	ug/Kg	ND(0.07)	ND(0.13)	ND(0.10)	ND(0.09)	ND(0.08)	ND(0.07)	ND(0.11)	ND(0.09)	ND(0.07)	ND(0.08)
PCB-101	ug/Kg	1.4 J	92 J	270 J	23 J	2.2 J	ND(0.01)	100 J	610 J	200 J	4.1 J
PCB-105	ug/Kg	ND(0.01)	45 J	31 J	4.4 J	ND(0.01)	ND(0.01)	13 J	220 J	15	ND(0.01)
PCB-114	ug/Kg	ND(0.01)	ND(0.02)	ND(0.02)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.02)	ND(0.01)	ND(0.01)	ND(0.01)

Table C-3 Analytical Data (E&E, 2009).

Location ID: / Depth Interval (ft): / Sample Date:	Units:	YC-013 4 - 5 6/24/2009	YC-014 0 - 1 6/25/2009	YC-014 1 - 2 6/25/2009	YC-014 2 - 3 6/25/2009	YC-014 3 - 4 6/25/2009	YC-014 4 - 5 6/25/2009	YC-015 0 - 1 7/7/2009	YC-015 1 - 2 7/7/2009	YC-015 2 - 3 7/7/2009	YC-015 3 - 4 7/7/2009
METALS											
Chromium	mg/kg	39.8 J	140 J	291 J	144 J	46.8 J	50.0 J	188 J	270 J	69.4 J	33.3 J
Lead	mg/kg	5.2 J	213 J	455 J	458 J	27.4 J	4.3 J	619 J	937 J	129 J	8.3 J
Mercury	mg/kg	0.091 J	1.1 J	1.1 J	0.81 J	0.18 J	0.053 J	0.71 J	1.7 J	0.13 J	0.060 J
Zinc	mg/kg	47.5 J	321 J	417 J	415 J	53.3 J	42.7 J	668 J	516 J	122 J	30.4 J
TOTAL PETROLEUM HYDROCARBONS											
Bunker C	mg/kg	ND(4.6)	ND(6.9)	ND(6.0)	ND(24)	ND(4.4)	ND(4.6)	ND(110)	ND(290)	ND(22)	ND(4.2)
Diesel Fuel	mg/kg	ND(0.84)	56 J	25 J	130 J	15 J	ND(0.83)	710 J	2300 J	130 J	14 J
Fuel Oil 4 & 5	mg/kg	ND(4.6)	ND(6.9)	ND(6.0)	ND(24)	ND(4.4)	ND(4.6)	ND(110)	ND(290)	ND(22)	ND(4.2)
Hydraulc Fluid	mg/kg	ND(4.6)	ND(6.9)	ND(6.0)	ND(24)	ND(4.4)	ND(4.6)	ND(110)	ND(290)	ND(22)	ND(4.2)
Jet A	mg/kg	ND(4.7)	ND(6.9)	ND(6.0)	ND(25)	ND(4.4)	ND(4.6)	ND(120)	ND(290)	ND(22)	ND(4.3)
JP4	mg/kg	ND(4.6)	ND(6.9)	ND(6.0)	ND(24)	ND(4.4)	ND(4.6)	ND(110)	ND(290)	ND(22)	ND(4.2)
JP5	mg/kg	ND(4.6)	ND(6.9)	ND(6.0)	ND(24)	ND(4.4)	ND(4.6)	ND(110)	ND(290)	ND(22)	ND(4.2)
JP8	mg/kg	ND(4.6)	ND(6.9)	ND(6.0)	ND(24)	ND(4.4)	ND(4.6)	ND(110)	ND(290)	ND(22)	ND(4.2)
Kerosene	mg/kg	ND(4.6)	ND(6.9)	ND(6.0)	ND(24)	ND(4.4)	ND(4.6)	ND(110)	ND(290)	ND(22)	ND(4.2)
Mineral Spirits	mg/kg	ND(4.6)	ND(6.9)	ND(6.0)	ND(24)	ND(4.4)	ND(4.6)	ND(110)	ND(290)	ND(22)	ND(4.2)
Motor Oil	mg/kg	ND(4.9)	130 J	51 J	250 J	22 J	ND(4.8)	2400 J	6100 J	400 J	27 J
Gasoline	ug/kg	ND(480)	ND(710)	ND(610)	1300 J	ND(450)	ND(470)	ND(590)	730 J	550 J	ND(440)
PESTICIDES											
4,4'-DDE	ug/kg	ND(2.3)	ND(83)	ND(1,400)	ND(95)	ND(2.1)	ND(2.2)	ND(1,100)	ND(3,400)	ND(740)	ND(41)
4,4'-DDT	ug/kg	ND(3.1)	ND(110)	ND(2,000)	ND(130)	ND(2.9)	ND(3.0)	ND(3.8)	ND(77)	ND(1,000)	ND(2.8)
4,4'-TDE/DDD	ug/kg	ND(2.5)	ND(3.8)	ND(32)	ND(2.7)	ND(2.4)	ND(2.5)	ND(1,300)	ND(63)	ND(2.4)	ND(2.3)
alpha-Chlordane	ug/kg	ND(3.0)	ND(4.4)	ND(38)	ND(3.1)	ND(2.8)	ND(2.9)	ND(1,500)	ND(4,400)	ND(970)	ND(2.7)
Dieldrin	ug/kg	ND(1.5)	ND(57)	ND(990)	ND(65)	ND(1.5)	ND(1.5)	ND(770)	ND(2,300)	ND(510)	ND(28)
gamma-Chlordane	ug/kg	ND(3.0)	ND(4.4)	ND(38)	ND(3.1)	ND(2.8)	ND(2.9)	ND(1,500)	ND(4,400)	ND(970)	ND(2.7)
POLYCHLORINATED BIPHENYLS (PCBs) - Congener Method											
PCB-8	ug/Kg	ND(0.07)	ND(0.10)	2.9 J	ND(0.07)	ND(0.07)	ND(0.07)	59	ND(4.4)	ND(0.07)	ND(0.06)
PCB-18	ug/Kg	ND(0.06)	ND(0.08)	20	ND(0.06)	ND(0.05)	ND(0.06)	ND(0.07)	ND(3.5)	ND(0.05)	ND(0.05)
PCB-28	ug/Kg	ND(0.03)	ND(0.04)	64 J	ND(0.03)	ND(0.03)	ND(0.03)	ND(0.04)	ND(1.8)	ND(0.03)	ND(0.03)
PCB-44	ug/Kg	0.81 J	ND(0.02)	15	1.9 J	ND(0.01)	ND(0.01)	84 J	1500 J	78 J	2.1 J
PCB-52	ug/Kg	ND(0.01)	3.2 J	170 J	13 J	2.5 J	ND(0.01)	270 J	3800 J	430 J	5.3 J
PCB-66	ug/Kg	0.94 J	5.6 J	120 J	14 J	1.7 J	ND(0.01)	310 J	4600 J	240 J	6.0 J
PCB-77	ug/Kg	ND(0.08)	ND(0.13)	ND(0.11)	ND(0.09)	ND(0.08)	ND(0.08)	ND(0.10)	ND(5.3)	ND(0.08)	1.1
PCB-81	ug/Kg	ND(0.08)	ND(0.13)	ND(0.11)	ND(0.09)	ND(0.08)	ND(0.08)	ND(0.10)	ND(5.3)	ND(0.08)	ND(0.08)
PCB-101	ug/Kg	1.3 J	10 J	250 J	25 J	3.7 J	ND(0.01)	930 J	6400 J	340 J	8.2 J
PCB-105	ug/Kg	0.89 J	2.7 J	22 J	3.6 J	ND(0.01)	ND(0.01)	150	1700	88	2.3
PCB-114	ug/Kg	ND(0.01)	ND(0.02)	ND(0.02)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.02)	ND(0.88)	ND(0.01)	ND(0.01)

Table C-3 Analytical Data (E&E, 2009).

Location ID: / Depth Interval (ft): / Sample Date:	Units:	YC-015 4 - 5 7/7/2009	YC-016 0 - 1 7/1/2009	YC-016 1 - 2 7/1/2009	YC-016 2 - 3 7/1/2009	YC-017 0 - 1 6/23/2009	YC-017 1 - 2 6/23/2009	YC-017 2 - 3 6/23/2009	YC-017 3 - 4 6/23/2009	YC-017 4 - 5 6/23/2009	YC-018 0 - 1 6/23/2009
METALS											
Chromium	mg/kg	64.2 J	87.8 J	159 J	116 J	170 J	252 J	164 J	60.8 J	39.2 J	97.6 J
Lead	mg/kg	7.3 J	288 J	697 J	193 J	258 J	449 J	427 J	38.1 J	6.3 J	262 J
Mercury	mg/kg	ND(0.04)	0.36	0.65	0.62	0.39 J	0.27 J	0.22 J	0.14 J	0.077 J	0.53 J
Zinc	mg/kg	61.6 J	341 J	594 J	265 J	350 J	507 J	508 J	93.7 J	30.7 J	454 J
TOTAL PETROLEUM HYDROCARBONS											
Bunker C	mg/kg	ND(5.7)	ND(26)	ND(53)	ND(4.7)	ND(34)	ND(6.0)	ND(5.5)	ND(4.9)	ND(4.4)	ND(5.7)
Diesel Fuel	mg/kg	ND(1.0)	67 J	570 J	47 J	170 J	80 J	68 J	13 J	ND(0.79)	55 J
Fuel Oil 4 & 5	mg/kg	ND(5.7)	ND(26)	ND(53)	ND(4.7)	ND(34)	ND(6.0)	ND(5.5)	ND(4.9)	ND(4.4)	ND(5.7)
Hydraulc Fluid	mg/kg	ND(5.7)	ND(26)	ND(53)	ND(4.7)	ND(34)	ND(6.0)	ND(5.5)	ND(4.9)	ND(4.4)	ND(5.7)
Jet A	mg/kg	ND(5.8)	ND(26)	ND(53)	ND(4.7)	ND(34)	ND(6.1)	ND(5.6)	ND(5.0)	ND(4.4)	ND(5.7)
JP4	mg/kg	ND(5.7)	ND(26)	ND(53)	ND(4.7)	ND(34)	ND(6.0)	ND(5.5)	ND(4.9)	ND(4.4)	ND(5.7)
JP5	mg/kg	ND(5.7)	ND(26)	ND(53)	ND(4.7)	ND(34)	ND(6.0)	ND(5.5)	ND(4.9)	ND(4.4)	ND(5.7)
JP8	mg/kg	ND(5.7)	ND(26)	ND(53)	ND(4.7)	ND(34)	ND(6.0)	ND(5.5)	ND(4.9)	ND(4.4)	ND(5.7)
Kerosene	mg/kg	ND(5.7)	ND(26)	ND(53)	ND(4.7)	ND(34)	ND(6.0)	ND(5.5)	ND(4.9)	ND(4.4)	ND(5.7)
Mineral Spirits	mg/kg	ND(5.7)	ND(26)	ND(53)	ND(4.7)	ND(34)	ND(6.0)	ND(5.5)	ND(4.9)	ND(4.4)	ND(5.7)
Motor Oil	mg/kg	ND(6.1)	140 J	1000 J	120 J	510 J	150 J	150 J	21 J	ND(4.6)	87 J
Gasoline	ug/kg	ND(590) U J	ND(530)	3200 J	ND(480)	ND(690)	ND(620)	ND(570)	ND(510)	ND(450)	ND(580)
PESTICIDES											
4,4'-DDE	ug/kg	ND(2.8)	ND(250)	ND(1,300)	ND(56)	ND(81)	ND(73)	ND(67)	8.7 J	ND(2.1)	ND(55)
4,4'-DDT	ug/kg	ND(3.8)	ND(3.4)	ND(3.5)	ND(3.1)	ND(110)	ND(100)	ND(3.7)	ND(3.3)	ND(2.9)	ND(75)
4,4'-TDE/DDD	ug/kg	ND(3.1)	ND(280)	ND(2.9)	ND(2.5)	ND(3.7)	ND(3.3)	ND(3.0)	ND(2.7)	ND(2.4)	ND(62)
alpha-Chlordane	ug/kg	ND(3.6)	ND(330)	ND(1,700)	ND(3.0)	ND(4.3)	ND(96)	ND(3.5)	ND(3.1)	ND(2.8)	ND(72)
Dieldrin	ug/kg	ND(1.9)	ND(170)	ND(880)	ND(39)	ND(2.2)	ND(50)	ND(1.8)	ND(1.6)	ND(1.5)	ND(38)
gamma-Chlordane	ug/kg	ND(3.6)	ND(330)	ND(1,700)	ND(3.0)	ND(4.3)	ND(96)	ND(3.5)	ND(3.1)	ND(2.8)	ND(72)
POLYCHLORINATED BIPHENYLS (PCBs) - Congener Method											
PCB-8	ug/Kg	ND(0.09)	ND(0.08)	ND(0.08)	ND(0.07)	3.5	ND(0.09)	ND(0.08)	ND(0.07)	ND(0.07)	ND(0.09)
PCB-18	ug/Kg	ND(0.07)	ND(0.06)	ND(0.06)	0.94 J	12	ND(0.07)	ND(0.07)	ND(0.06)	ND(0.05)	ND(0.07)
PCB-28	ug/Kg	ND(0.04)	ND(0.03)	ND(0.03)	ND(0.03)	4.6	12	ND(0.03)	ND(0.03)	ND(0.03)	5
PCB-44	ug/Kg	ND(0.02)	19 J	ND(0.02)	1.3 J	2.0 J	6.7 J	3.9 J	ND(0.01)	ND(0.01)	8.4 J
PCB-52	ug/Kg	3.3 J	24 J	ND(0.02)	3.9 J	6.0 J	38 J	14 J	ND(0.01)	ND(0.01)	26 J
PCB-66	ug/Kg	4.1 J	52 J	260 J	8.7 J	8.5 J	22 J	21 J	ND(0.01)	ND(0.01)	27 J
PCB-77	ug/Kg	ND(0.10)	36	110	ND(0.09)	ND(0.12)	ND(0.11)	ND(0.10)	ND(0.09)	ND(0.08)	ND(0.10)
PCB-81	ug/Kg	ND(0.10)	ND(0.09)	ND(0.10)	ND(0.09)	ND(0.12)	ND(0.11)	ND(0.10)	ND(0.09)	ND(0.08)	ND(0.10)
PCB-101	ug/Kg	5.3 J	110 J	380 J	15 J	14 J	40 J	36 J	2.7 J	ND(0.01)	40 J
PCB-105	ug/Kg	1.4	34 J	120 J	1.6 J	3.4 J	7.7 J	24 J	ND(0.01)	ND(0.01)	5.9 J
PCB-114	ug/Kg	ND(0.02)	24	ND(0.02)	ND(0.01)	ND(0.02)	ND(0.02)	ND(0.02)	ND(0.01)	ND(0.01)	ND(0.02)

Table C-3 Analytical Data (E&E, 2009).

Location ID: / Depth Interval (ft): / Sample Date:	Units:	YC-018 1 - 2 6/23/2009	YC-018 2 - 3 6/23/2009	YC-018 3 - 4 6/23/2009	YC-018 4 - 5 6/23/2009	YC-019 0 - 1 6/22/2009	YC-019 1 - 2 6/22/2009	YC-019 2 - 3 6/22/2009	YC-019 3 - 4 6/22/2009	YC-019 4 - 5 6/22/2009	YC-020 0 - 1 6/22/2009
METALS											
Chromium	mg/kg	161 J	229 J	270 J	127 J	125 J	257 J	148 J	83.6 J	48.8 J	98.2 J
Lead	mg/kg	722 J	394 J	448 J	428 J	254 J	809 J	409 J	86.2 J	11.7 J	106 J
Mercury	mg/kg	0.55 J	0.26 J	0.56 J	0.36 J	0.63 J	0.51 J	0.22 J	0.23 J	0.076 J	0.41 J
Zinc	mg/kg	681 J	351 J	580 J	522 J	328 J	644 J	394 J	154 J	45.0 J	192 J
TOTAL PETROLEUM HYDROCARBONS											
Bunker C	mg/kg	ND(29)	ND(30)	ND(57)	ND(51)	ND(6.1)	ND(29)	ND(28)	ND(5.3)	ND(5.1)	ND(6.4)
Diesel Fuel	mg/kg	210 J	200 J	440 J	360 J	76 J	250 J	150 J	27 J	ND(0.93)	19 J
Fuel Oil 4 & 5	mg/kg	ND(29)	ND(30)	ND(57)	ND(51)	ND(6.1)	ND(29)	ND(28)	ND(5.3)	ND(5.1)	ND(6.4)
Hydraulc Fluid	mg/kg	ND(29)	ND(30)	ND(57)	ND(51)	ND(6.1)	ND(29)	ND(28)	ND(5.3)	ND(5.1)	ND(6.4)
Jet A	mg/kg	ND(30)	ND(31)	ND(58)	ND(51)	ND(6.2)	ND(30)	ND(28)	ND(5.4)	ND(5.2)	ND(6.5)
JP4	mg/kg	ND(29)	ND(30)	ND(57)	ND(51)	ND(6.1)	ND(29)	ND(28)	ND(5.3)	ND(5.1)	ND(6.4)
JP5	mg/kg	ND(29)	ND(30)	ND(57)	ND(51)	ND(6.1)	ND(29)	ND(28)	ND(5.3)	ND(5.1)	ND(6.4)
JP8	mg/kg	ND(29)	ND(30)	ND(57)	ND(51)	ND(6.1)	ND(29)	ND(28)	ND(5.3)	ND(5.1)	ND(6.4)
Kerosene	mg/kg	ND(29)	ND(30)	ND(57)	ND(51)	ND(6.1)	ND(29)	ND(28)	ND(5.3)	ND(5.1)	ND(6.4)
Mineral Spirits	mg/kg	ND(29)	ND(30)	ND(57)	ND(51)	ND(6.1)	ND(29)	ND(28)	ND(5.3)	ND(5.1)	ND(6.4)
Motor Oil	mg/kg	690 J	520 J	1100 J	1000 J	120 J	440 J	220 J	43 J	ND(5.5)	62 J
Gasoline	ug/kg	ND(600)	ND(630)	9200 J	11000	ND(630)	12000 J	3900	ND(550)	ND(530)	ND(660)
PESTICIDES											
4,4'-DDE	ug/kg	ND(1,100)	ND(590)	ND(280)	ND(250)	ND(59)	ND(430)	ND(130)	ND(2.6)	ND(2.5)	ND(32)
4,4'-DDT	ug/kg	ND(1,600)	ND(810)	ND(380)	ND(340)	ND(82)	ND(590)	ND(180)	ND(3.5)	ND(3.4)	ND(44)
4,4'-TDE/DDD	ug/kg	ND(3.2)	ND(3.3)	ND(3.1)	ND(2.8)	ND(3.3)	ND(480)	ND(150)	ND(2.9)	ND(2.8)	ND(3.6)
alpha-Chlordane	ug/kg	ND(3.7)	ND(3.9)	ND(3.7)	ND(3.2)	ND(3.9)	ND(560)	ND(3.5)	ND(34)	ND(3.3)	ND(4.2)
Dieldrin	ug/kg	ND(780)	ND(410)	ND(190)	ND(1.7)	ND(41)	ND(290)	ND(92)	ND(18)	ND(1.7)	ND(22)
gamma-Chlordane	ug/kg	ND(1,500)	ND(780)	ND(3.7)	ND(3.2)	ND(3.9)	ND(560)	ND(3.5)	ND(3.4)	ND(3.3)	ND(4.2)
POLYCHLORINATED BIPHENYLS (PCBs) - Congener Method											
PCB-8	ug/Kg	24	18	ND(0.09)	ND(0.08)	ND(0.09)	3	ND(0.08)	ND(0.08)	ND(0.08)	ND(0.10)
PCB-18	ug/Kg	18	100	ND(0.07)	ND(0.06)	ND(0.07)	30	ND(0.07)	ND(0.06)	ND(0.06)	ND(0.08)
PCB-28	ug/Kg	33	15	3.3	ND(0.03)	ND(0.04)	ND(0.04)	ND(0.03)	ND(0.03)	ND(0.03)	ND(0.04)
PCB-44	ug/Kg	210 J	60 J	13 J	2.3 J	3.8 J	21 J	2.8 J	ND(0.02)	ND(0.02)	ND(0.02)
PCB-52	ug/Kg	470 J	250 J	35 J	7.7 J	9.1 J	160 J	27 J	5.3 J	ND(0.02)	2.1 J
PCB-66	ug/Kg	680 J	380 J	96 J	12 J	16 J	95 J	16 J	ND(0.02)	ND(0.02)	ND(0.02)
PCB-77	ug/Kg	ND(0.11)	ND(0.11)	ND(0.10)	ND(0.09)	ND(0.11)	ND(0.11)	ND(0.10)	ND(0.10)	ND(0.09)	ND(0.12)
PCB-81	ug/Kg	ND(0.11)	ND(0.11)	ND(0.10)	ND(0.09)	ND(0.11)	ND(0.11)	ND(0.10)	ND(0.10)	ND(0.09)	ND(0.12)
PCB-101	ug/Kg	770 J	430 J	120 J	19 J	26 J	160 J	23 J	5.1 J	ND(0.02)	6.4 J
PCB-105	ug/Kg	300 J	100 J	21 J	7.8 J	6.7 J	30 J	7.4 J	ND(0.02)	ND(0.02)	2.6 J
PCB-114	ug/Kg	ND(0.02)	ND(0.02)	ND(0.02)	ND(0.01)	ND(0.02)	ND(0.02)	ND(0.02)	ND(0.02)	ND(0.02)	ND(0.02)

Table C-3 Analytical Data (E&E, 2009).

Location ID:		YC-020	YC-020	YC-020	YC-020	YC-021	YC-021	YC-021	YC-021	YC-021	YC-022
Depth Interval (ft):		1 - 2	2 - 3	3 - 4	4 - 5	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	0 - 1
Sample Date:	Units:	6/22/2009	6/22/2009	6/22/2009	6/22/2009	6/22/2009	6/22/2009	6/22/2009	6/22/2009	6/22/2009	6/22/2009
METALS											
Chromium	mg/kg	87.9 J	223 J	171 J	112 J	94.1 J	169 J	262 J	208 J	168 J	59.6 J
Lead	mg/kg	271 J	483 J	453 J	426 J	154 J	320 J	530 J	525 J	248 J	70.1 J
Mercury	mg/kg	0.47 J	0.76 J	0.85 J	0.58 J	0.34 J	0.16 J	0.37 J	0.39 J	0.34 J	0.25 J
Zinc	mg/kg	296 J	448 J	458 J	387 J	215 J	336 J	478 J	582 J	458 J	131 J
TOTAL PETROLEUM HYDROCARBONS											
Bunker C	mg/kg	ND(24)	ND(30)	ND(29)	ND(4.5)	ND(5.1)	ND(4.8)	ND(32)	ND(30)	ND(33)	ND(5.2)
Diesel Fuel	mg/kg	270 J	200 J	170 J	54 J	39 J	44 J	73 J	220 J	99 J	42 J
Fuel Oil 4 & 5	mg/kg	ND(24)	ND(30)	ND(29)	ND(4.5)	ND(5.1)	ND(4.8)	ND(32)	ND(30)	ND(33)	ND(5.2)
Hydraulc Fluid	mg/kg	ND(24)	ND(30)	ND(29)	ND(4.5)	ND(5.1)	ND(4.8)	ND(32)	ND(30)	ND(33)	ND(5.2)
Jet A	mg/kg	ND(25)	ND(31)	ND(29)	ND(4.5)	ND(5.2)	ND(4.8)	ND(32)	ND(31)	ND(33)	ND(5.2)
JP4	mg/kg	ND(24)	ND(30)	ND(29)	ND(4.5)	ND(5.1)	ND(4.8)	ND(32)	ND(30)	ND(33)	ND(5.2)
JP5	mg/kg	ND(24)	ND(30)	ND(29)	ND(4.5)	ND(5.1)	ND(4.8)	ND(32)	ND(30)	ND(33)	ND(5.2)
JP8	mg/kg	ND(24)	ND(30)	ND(29)	ND(4.5)	ND(5.1)	ND(4.8)	ND(32)	ND(30)	ND(33)	ND(5.2)
Kerosene	mg/kg	ND(24)	ND(30)	ND(29)	ND(4.5)	ND(5.1)	ND(4.8)	ND(32)	ND(30)	ND(33)	ND(5.2)
Mineral Spirits	mg/kg	ND(24)	ND(30)	ND(29)	ND(4.5)	ND(5.1)	ND(4.8)	ND(32)	ND(30)	ND(33)	ND(5.2)
Motor Oil	mg/kg	4900 J	410 J	310 J	99 J	140 J	96 J	250 J	530 J	340 J	64 J
Gasoline	ug/kg	ND(500)	ND(630)	6900	3600	ND(530)	1800 J	2500	6100	2300	ND(530)
PESTICIDES											
4,4'-DDE	ug/kg	ND(470)	ND(300	ND(140)		ND(120)	ND(230)	ND(310)	ND(150)	ND(95)	ND(2.5)
4,4'-DDT	ug/kg	ND(650)	ND(410)	ND(190)	ND(150)	ND(170)	ND(320)	ND(420)	ND(200)	ND(130)	ND(3.4)
4,4'-TDE/DDD	ug/kg	ND(530)	ND(330)	ND(160)	ND(120)	ND(2.8)	ND(260)	ND(350)	ND(3.3)	ND(3.6)	ND(2.8)
alpha-Chlordane	ug/kg	ND(620)	ND(390)	ND(3.7)	ND(2.8)	ND(3.3)	ND(3.1)	ND(400)	ND(3.9)	ND(4.2)	ND(3.3)
Dieldrin	ug/kg	ND(320)	ND(200)	ND(96)	ND(1.5)	ND(86)	ND(160)	ND(210)	ND(100)	ND(2.2)	ND(1.7)
gamma-Chlordane	ug/kg	ND(620)	ND(390)	ND(3.7)	ND(2.8)	ND(3.3)	ND(3.1)	ND(400)	ND(3.9)	ND(4.2)	ND(3.3)
POLYCHLORINATED BIPHENYLS (PCBs) - Congener Method											
PCB-8	ug/Kg	1.3	4	ND(0.09)	ND(0.07)	ND(0.08)	2.9	ND(0.10)	ND(0.09)	ND(0.10)	ND(0.08)
PCB-18	ug/Kg	ND(0.06)	39	ND(0.07)	ND(0.05)	ND(0.06)	ND(0.06)	ND(0.08)	ND(0.07)	ND(0.08)	ND(0.06)
PCB-28	ug/Kg	2	32	ND(0.04)	ND(0.03)	ND(0.03)	ND(0.03)	3.8	ND(0.04)	ND(0.04)	ND(0.03)
PCB-44	ug/Kg	4.1 J	23 J	3.4 J	1.7 J	ND(0.02)	14	18 J	6.4 J	2.3 J	ND(0.02)
PCB-52	ug/Kg	9.1 J	100 J	7.8 J	5.4 J	3.5 J	41 J	50 J	18 J	7.5 J	1.9 J
PCB-66	ug/Kg	16 J	64 J	ND(0.02)	ND(0.01)	5.0 J	58 J	93 J	40 J	13 J	3.4 J
PCB-77	ug/Kg	ND(0.09)	ND(0.11)	ND(0.10)	ND(0.08)	ND(0.09)	ND(0.09)	ND(0.12)	ND(0.11)	ND(0.12)	ND(0.09)
PCB-81	ug/Kg	ND(0.09)	ND(0.11)	ND(0.10)	ND(0.08)	ND(0.09)	ND(0.09)	ND(0.12)	ND(0.11)	ND(0.12)	ND(0.09)
PCB-101	ug/Kg	25 J	68 J	23 J	8.9 J	7.8 J	60 J	140 J	60 J	30 J	5.3 J
PCB-105	ug/Kg	8.1 J	22 J	ND(0.02)	2.7 J	1.8 J	22 J	43 J	14 J	8.1 J	1.3 J
PCB-114	ug/Kg	ND(0.01)	ND(0.02)	ND(0.02)	ND(0.01)	ND(0.02)	ND(0.01)	ND(0.02)	ND(0.02)	ND(0.02)	ND(0.02)

Table C-3 Analytical Data (E&E, 2009).

Location ID: Depth Interval (ft): Sample Date:	Units:	YC-022 1 - 2 6/22/2009	YC-022 2 - 3 6/22/2009	YC-022 3 - 4 6/22/2009	YC-022 4 - 5 6/22/2009	YC-023 0 - 1 6/18/2009	YC-023 1 - 2 6/18/2009	YC-023 2 - 3 6/18/2009	YC-023 3 - 4 6/18/2009	YC-023 4 - 5 6/18/2009	YC-024 0 - 1 6/22/2009
METALS											
Chromium	mg/kg	66.5 J	300 J	162 J	153 J	91.5 J	426 J	188 J	51.8 J	58.4 J	123 J
Lead	mg/kg	137 J	178 J	333 J	307 J	156 J	561 J	288 J	8.3 J	4.4 J	280 J
Mercury	mg/kg	0.20 J	0.50 J	0.51 J	0.58 J	0.68	0.97	0.71	0.036	0.053	0.54 J
Zinc	mg/kg	197 J	278 J	400 J	371 J	213 J	517 J	422 J	52.7 J	53.6 J	320 J
TOTAL PETROLEUM HYDROCARBONS											
Bunker C	mg/kg	ND(44)	ND(6.1)	ND(27)	ND(25)	ND(4.7)	ND(7.0)	ND(6.5)	ND(5.0)	ND(5.6)	ND(28)
Diesel Fuel	mg/kg	230 J	31 J	80 J	200 J	25 J	61 J	95 J	20 J	ND(1.0)	140 J
Fuel Oil 4 & 5	mg/kg	ND(44)	ND(6.1)	ND(27)	ND(25)	ND(4.7)	ND(7.0)	ND(6.5)	ND(5.0)	ND(5.6)	ND(28)
Hydraulc Fluid	mg/kg	ND(44)	ND(6.1)	ND(27)	ND(25)	ND(4.7)	ND(7.0)	ND(6.5)	ND(5.0)	5.6	ND(28)
Jet A	mg/kg	ND(45)	ND(6.1)	ND(27)	ND(25)	ND(4.7)	ND(7.1)	ND(6.6)	ND(5.0)	ND(5.7)	ND(29)
JP4	mg/kg	ND(44)	ND(6.1)	ND(27)	ND(25)	ND(4.7)	ND(7.0)	ND(6.5)	ND(5.0)	ND(5.6)	ND(28)
JP5	mg/kg	ND(44)	ND(6.1)	ND(27)	ND(25)	ND(4.7)	ND(7.0)	ND(6.5)	ND(5.0)	ND(5.6)	28
JP8	mg/kg	ND(44)	ND(6.1)	ND(27)	ND(25)	ND(4.7)	ND(7.0)	ND(6.5)	ND(5.0)	ND(5.6)	ND(28)
Kerosene	mg/kg	ND(44)	ND(6.1)	ND(27)	ND(25)	ND(4.7)	ND(7.0)	ND(6.5)	ND(5.0)	ND(5.6)	ND(28)
Mineral Spirits	mg/kg	ND(44)	ND(6.1)	ND(27)	ND(25)	ND(4.7)	ND(7.0)	ND(6.5)	ND(5.0)	ND(5.6)	ND(28)
Motor Oil	mg/kg	350 J	50 J	140 J	400 J	57 J	140 J	270 J	40 J	ND(6.0)	190 J
Gasoline	ug/kg	650	ND(630)	1800 J	8200	ND(470)	ND(720)	ND(670)	ND(510)	ND(580)	ND(590)
PESTICIDES											
4,4'-DDE	ug/kg	ND(110)	ND(29)	ND(260)	ND(240)	ND(2.2)	ND(3.4)	ND(3.2)	ND(2.4)	ND(2.7)	ND(140)
4,4'-DDT	ug/kg	ND(150)	ND(40)	ND(350)	ND(330)	ND(3.1)	ND(4.7)	ND(4.3)	ND(3.3)	ND(3.8)	ND(190)
4,4'-TDE/DDD	ug/kg	ND(120)		ND(2.9)	ND(2.7)	ND(2.5)	ND(3.8)	ND(3.6)	ND(2.7)	ND(3.1)	ND(3.1)
alpha-Chlordane	ug/kg	ND(140)	ND(3.9)	ND(3.4)	ND(3.2)	ND(2.9)	ND(4.4)	ND(4.1)	ND(3.2)	ND(3.6)	ND(3.6)
Dieldrin	ug/kg	ND(74)	ND(2.0)	ND(180)	ND(170)	ND(1.5)	ND(2.3)	ND(2.2)	ND(1.7)	ND(1.9)	ND(95)
gamma-Chlordane	ug/kg	ND(140)	ND(39)	ND(3.4)	ND(3.2)	ND(2.9)	ND(4.4)	ND(4.1)	ND(3.2)	ND(3.6)	ND(180)
POLYCHLORINATED BIPHENYLS (PCBs) - Congener Method											
PCB-8	ug/Kg	ND(0.07)	ND(0.09)	ND(0.08)	ND(0.08)	0.84	5.5	ND(0.10)	ND(0.07)	ND(0.09)	2.9
PCB-18	ug/Kg	ND(0.05)	ND(0.07)	ND(0.06)	ND(0.06)	ND(0.06)	26	ND(0.08)	ND(0.06)	ND(0.07)	17
PCB-28	ug/Kg	ND(0.03)	ND(0.04)	1	ND(0.03)	0.95 J	8.6 J	ND(0.04)	ND(0.03)	ND(0.03)	4.6
PCB-44	ug/Kg	2.3 J	1.7 J	6.9 J	ND(0.01)	2.0 J	35 J	2.6 J	ND(0.01)	ND(0.02)	6.0 J
PCB-52	ug/Kg	8.7 J	5.3 J	19 J	25 J	5.8 J	56 J	6.8 J	ND(0.01)	ND(0.02)	16 J
PCB-66	ug/Kg	6.9 J	9.2 J	38 J	12 J	10 J	110 J	9.6 J	ND(0.01)	ND(0.02)	33 J
PCB-77	ug/Kg	ND(0.08)	ND(0.11)	ND(0.10)	ND(0.09)	ND(0.09)	ND(0.13)	ND(0.12)	ND(0.09)	ND(0.10)	ND(0.10)
PCB-81	ug/Kg	ND(0.08)	ND(0.11)	ND(0.10)	ND(0.09)	ND(0.09)	ND(0.13)	ND(0.12)	ND(0.09)	ND(0.10)	ND(0.10)
PCB-101	ug/Kg	9.8 J	11 J	68 J	80 J	21	120	14	0.24 J	ND(0.02)	48 J
PCB-105	ug/Kg	2.0 J	2.5 J	24 J	21 J	ND(0.01)	57	4.4	ND(0.01)	ND(0.02)	9.6 J
PCB-114	ug/Kg	ND(0.01)	ND(0.02)	ND(0.02)	ND(0.01)	ND(0.01)	ND(0.02)	10	ND(0.01)	ND(0.02)	ND(0.02)

Table C-3 Analytical Data (E&E, 2009).

Location ID: / Depth Interval (ft): / Sample Date:	Units:	YC-024 1 - 2 6/22/2009	YC-024 2 - 3 6/22/2009	YC-024 3 - 4 6/22/2009	YC-024 4 - 5 6/22/2009	YC-025 0 - 1 6/18/2009	YC-025 1 - 2 6/18/2009	YC-025 2 - 3 6/18/2009	YC-025 3 - 4 6/18/2009	YC-025 4 - 5 6/18/2009	YC-026 0 - 1 6/18/2009
METALS											
Chromium	mg/kg	189 J	276 J	175 J	82.9 J	106 J	287 J	194 J	134 J	74.9 J	218 J
Lead	mg/kg	509 J	457 J	218 J	49.2 J	204 J	439 J	363 J	103 J	12.9 J	1210 J
Mercury	mg/kg	0.71 J	0.64 J	0.79 J	0.33 J	0.46	0.6	0.65	0.5	0.12	0.77
Zinc	mg/kg	629 J	485 J	407 J	119 J	271 J	391 J	404 J	225 J	80.5 J	613 J
TOTAL PETROLEUM HYDROCARBONS											
Bunker C	mg/kg	ND(26)	ND(33)	ND(6.9)	ND(6.0)	ND(5.0)	ND(5.5)	ND(6.3)	ND(6.3)	ND(5.9)	ND(5.5)
Diesel Fuel	mg/kg	74 J	220 J	69 J	ND(1.1)	52 J	68 J	63 J	38 J	11 J	120 J
Fuel Oil 4 & 5	mg/kg	ND(26)	ND(33)	ND(6.9)	ND(6.0)	ND(5.0)	ND(5.5)	ND(6.3)	ND(6.3)	ND(5.9)	ND(5.5)
Hydraulc Fluid	mg/kg	ND(26)	ND(33)	ND(6.9)	ND(6.0)	ND(5.0)	ND(5.5)	ND(6.3)	ND(6.3)	ND(5.9)	ND(5.5)
Jet A	mg/kg	ND(26)	ND(33)	ND(6.9)	ND(6.0)	ND(5.1)	ND(5.5)	ND(6.4)	ND(6.3)	ND(6.0)	ND(5.6)
JP4	mg/kg	ND(26)	ND(33)	ND(6.9)	ND(6.0)	ND(5.0)	ND(5.5)	ND(6.3)	ND(6.3)	ND(5.9)	ND(5.5)
JP5	mg/kg	ND(26)	ND(33)	ND(6.9)	ND(6.0)	ND(5.0)	ND(5.5)	ND(6.3)	ND(6.3)	ND(5.9)	ND(5.5)
JP8	mg/kg	ND(26)	ND(33)	ND(6.9)	ND(6.0)	ND(5.0)	ND(5.5)	ND(6.3)	ND(6.3)	ND(5.9)	ND(5.5)
Kerosene	mg/kg	ND(26)	ND(33)	ND(6.9)	ND(6.0)	ND(5.0)	ND(5.5)	ND(6.3)	ND(6.3)	ND(5.9)	ND(5.5)
Mineral Spirits	mg/kg	ND(26)	ND(33)	ND(6.9)	ND(6.0)	ND(5.0)	ND(5.5)	ND(6.3)	ND(6.3)	ND(5.9)	ND(5.5)
Motor Oil	mg/kg	93 J	270 J	110 J	ND(6.4)	140 J	180 J	140 J	91 J	22 J	450 J
Gasoline	ug/kg	1900	8600	950	ND(620)	ND(520)	ND(560)	1300 J	ND(650)	ND(610)	ND(570)
PESTICIDES											
4,4'-DDE	ug/kg	ND(300)	ND(320)	ND(3.3)	ND(2.9)	ND(2.4)	ND(2.7)	ND(3.1)	ND(3.0)	ND(2.9)	ND(2.7)
4,4'-DDT	ug/kg	ND(420)	ND(440)	ND(4.6)	ND(4.0)	ND(3.4)	ND(3.6)	ND(4.2)	ND(4.2)	ND(3.9)	ND(3.7)
4,4'-TDE/DDD	ug/kg	ND(340)	ND(3.6)	ND(3.7)	ND(3.3)	ND(2.7)	ND(3.0)	ND(3.5)	ND(3.4)	ND(3.2)	ND(3.0)
alpha-Chlordane	ug/kg	ND(400)	ND(4.2)	ND(4.4)	ND(3.8)	ND(3.2)	ND(3.5)	ND(4.0)	ND(4.0)	ND(3.8)	ND(3.5)
Dieldrin	ug/kg	ND(210)	ND(2.2)	ND(2.3)	ND(2.0)	ND(1.7)	ND(1.8)	ND(2.1)	ND(2.1)	ND(2.0)	ND(1.8)
gamma-Chlordane	ug/kg	ND(400)	ND(4.2)	ND(4.4)	ND(3.8)	ND(3.2)	ND(3.5)	ND(4.0)	ND(4.0)	ND(3.8)	ND(3.5)
POLYCHLORINATED BIPHENYLS (PCBs) - Congener Method											
PCB-8	ug/Kg	ND(0.08)	ND(0.10)	ND(0.10)	ND(0.09)	3.4	5.9	1.6	ND(0.10)	ND(0.09)	11
PCB-18	ug/Kg	ND(0.06)	ND(0.08)	ND(0.08)	ND(0.07)	22	39	8.2	ND(0.08)	ND(0.07)	ND(0.07)
PCB-28	ug/Kg	3.4	ND(0.04)	ND(0.04)	ND(0.04)	9.1 J	28 J	4.6 J	ND(0.04)	ND(0.04)	19 J
PCB-44	ug/Kg	7.9 J	5.4 J	ND(0.02)	ND(0.02)	9.1 J	19 J	16 J	1.0 J	0.25 J	17 J
PCB-52	ug/Kg	33 J	13 J	2.6 J	ND(0.02)	38 J	140 J	42 J	3.5 J	0.75 J	62 J
PCB-66	ug/Kg	38 J	21 J	2.8 J	ND(0.02)	41 J	92 J	58 J	4.4 J	ND(0.02)	83 J
PCB-77	ug/Kg	ND(0.09)	ND(0.12)	ND(0.12)	ND(0.11)	ND(0.09)	ND(0.10)	ND(0.12)	ND(0.11)	ND(0.11)	ND(0.10)
PCB-81	ug/Kg	ND(0.09)	ND(0.12)	ND(0.12)	ND(0.11)	ND(0.09)	ND(0.10)	ND(0.12)	ND(0.11)	ND(0.11)	ND(0.10)
PCB-101	ug/Kg	56 J	24 J	5.0 J	1.9 J	55	140	63	5.6	0.99	120
PCB-105	ug/Kg	12 J	7.5 J	1.2 J	ND(0.02)	20	21	20	1.2	ND(0.02)	28
PCB-114	ug/Kg	ND(0.02)	ND(0.02)	ND(0.02)	ND(0.02)	ND(0.01)	ND(0.02)	ND(0.02)	ND(0.02)	ND(0.02)	ND(0.02)

Table C-3 Analytical Data (E&E, 2009).

Location ID:		YC-026	YC-026	YC-026	YC-026	YC-029	YC-029	YC-029	YC-029	YC-029	YC-030
Depth Interval (ft):		1 - 2	2 - 3	3 - 4	4 - 5	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	0 - 1
Sample Date:	Units:	6/18/2009	6/18/2009	6/18/2009	6/18/2009	7/6/2009	7/6/2009	7/6/2009	7/6/2009	7/6/2009	7/6/2009
METALS											
Chromium	mg/kg	262 J	133 J	135 J	64.1 J	121 J	268 J	300 J	245 J	56.2 J	139 J
Lead	mg/kg	495 J	108 J	99.8 J	21.6 J	141 J	451 J	709 J	289 J	35.9 J	164 J
Mercury	mg/kg	0.97	0.8	0.45	0.084	0.62 J	0.91 J	0.83 J	0.66 J	0.44 J	0.58 J
Zinc	mg/kg	474 J	221 J	219 J	73.6 J	234 J	584 J	519 J	347 J	81.2 J	250 J
TOTAL PETROLEUM HYDROCARBONS											
Bunker C	mg/kg	ND(6.8)	ND(7.1)	ND(7.0)	ND(5.7)	ND(33)	ND(66)	ND(360)	ND(73)	ND(26)	ND(32)
Diesel Fuel	mg/kg	62 J	33 J	12 J	ND(1.0)	76 J	250 J	1100 J	290 J	66 J	110 J
Fuel Oil 4 & 5	mg/kg	ND(6.8)	ND(7.1)	ND(7.0)	ND(5.7)	ND(33)	ND(66)	ND(360)	ND(73)	26	ND(32)
Hydraulc Fluid	mg/kg	ND(6.8)	ND(7.1)	ND(7.0)	ND(5.7)	ND(33)	ND(66)	ND(360)	ND(73)	ND(26)	ND(32)
Jet A	mg/kg	ND(6.9)	ND(7.2)	ND(7.1)	ND(5.7)	ND(33)	ND(67)	ND(360)	ND(74)	ND(26)	ND(32)
JP4	mg/kg	ND(6.8)	ND(7.1)	ND(7.0)	ND(5.7)	ND(33)	ND(66)	ND(360)	ND(73)	ND(26)	ND(32)
JP5	mg/kg	ND(6.8)	ND(7.1)	ND(7.0)	ND(5.7)	ND(33)	ND(66)	ND(360)	ND(73)	ND(26)	ND(32)
JP8	mg/kg	ND(6.8)	ND(7.1)	ND(7.0)	ND(5.7)	ND(33)	ND(66)	ND(360)	ND(73)	ND(26)	ND(32)
Kerosene	mg/kg	ND(6.8)	ND(7.1)	ND(7.0)	ND(5.7)	ND(33)	ND(66)	ND(360)	ND(73)	ND(26)	ND(32)
Mineral Spirits	mg/kg	ND(6.8)	ND(7.1)	ND(7.0)	ND(5.7)	ND(33)	ND(66)	ND(360)	ND(73)	ND(26)	ND(32)
Motor Oil	mg/kg	140 J	85 J	28 J	ND(6.0)	230 J	870 J	3400 J	1000 J	230 J	340 J
Gasoline	ug/kg	2100 J	ND(740)	ND(720)	ND(590)	ND(680)	ND(680)	ND(740)	3000 J	ND(530)	ND(650)
PESTICIDES											
4,4'-DDE	ug/kg	ND(3.3)	ND(3.5)	ND(3.4)	ND(2.8)	ND(160)	ND(640)	ND(2,500)	ND(710)	ND(130)	ND(180)
4,4'-DDT	ug/kg	ND(4.5)	ND(4.8)	ND(4.7)	ND(3.8)	ND(4.4)	ND(4.4)	ND(4.8)	ND(4.9)	ND(3.5)	ND(4.2)
4,4'-TDE/DDD	ug/kg	ND(3.7)	ND(3.9)	ND(3.8)	ND(3.1)	ND(3.6)	ND(3.6)	ND(3.9)	ND(4.0)	ND(2.8)	ND(3.5)
alpha-Chlordane	ug/kg	ND(4.3)	ND(4.5)	ND(4.5)	ND(3.6)	ND(210)	ND(850)	ND(3,200)	ND(930)	ND(160)	ND(240)
Dieldrin	ug/kg	ND(2.3)	ND(2.4)	ND(2.3)	ND(1.9)	ND(110)	ND(440)	ND(1,700)	ND(490)	ND(86)	ND(130)
gamma-Chlordane	ug/kg	ND(4.3)	ND(4.5)	ND(4.5)	ND(3.6)	ND(210)	ND(850)	ND(3,200)	ND(930)	ND(160)	ND(240)
POLYCHLORINATED BIPHENYLS (PCBs) - Congener Method											
PCB-8	ug/Kg	ND(0.10)	ND(0.11)	ND(0.11)	ND(0.09)	2.8	ND(0.10)	ND(1.1)	ND(1.1)	ND(0.08)	ND(0.10)
PCB-18	ug/Kg	ND(0.08)	ND(0.09)	ND(0.09)	ND(0.07)	ND(0.08)	ND(0.08)	ND(0.88)	ND(0.88)	ND(0.06)	28
PCB-28	ug/Kg	3.1 J	ND(0.04)	ND(0.04)	ND(0.03)	ND(0.04)	ND(0.04)	55	ND(0.44)	1.3	9.9
PCB-44	ug/Kg	13 J	1.7 J	ND(0.02)	ND(0.02)	4.2 J	22 J	130	61 J	3.3 J	12 J
PCB-52	ug/Kg	34 J	4.6 J	5.6 J	ND(0.02)	8.7 J	51 J	330 J	150 J	8.3 J	21 J
PCB-66	ug/Kg	57 J	4.4 J	5.6 J	ND(0.02)	18 J	97 J	480 J	270 J	ND(0.02)	31 J
PCB-77	ug/Kg	ND(0.12)	ND(0.13)	ND(0.13)	ND(0.10)	53	61	ND(1.3)	ND(1.3)	ND(0.09)	18
PCB-81	ug/Kg	ND(0.12)	ND(0.13)	ND(0.13)	ND(0.10)	ND(0.12)	ND(0.12)	ND(1.3)	ND(1.3)	ND(0.09)	34
PCB-101	ug/Kg	66	6.2	7.3	1.1	32 J	230 J	800 J	450 J	23 J	51 J
PCB-105	ug/Kg	21	2.1	1.4	ND(0.02)	ND(0.02)	81	230	130	6.8	18
PCB-114	ug/Kg	53	3.2	ND(0.02)	ND(0.02)	ND(0.02)	ND(0.02)	ND(0.22)	ND(0.22)	ND(0.02)	37 J

Table C-3 Analytical Data (E&E, 2009).

Location ID:		YC-030	YC-030	YC-030	YC-030	YC-031	YC-031	YC-031	YC-031	YC-031	YC-032
Depth Interval (ft):		1 - 2	2 - 3	3 - 4	4 - 5	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	0 - 1
Sample Date:	Units:	7/6/2009	7/6/2009	7/6/2009	7/6/2009	7/7/2009	7/7/2009	7/7/2009	7/7/2009	7/7/2009	7/7/2009
METALS											
Chromium	mg/kg	235 J	267 J	231 J	83.7 J	146 J	247 J	75.4 J	45.8 J	38.5 J	310 J
Lead	mg/kg	682 J	453 J	201 J	34.8 J	249 J	567 J	102 J	16.7 J	5.7 J	978 J
Mercury	mg/kg	0.74 J	0.55 J	0.61 J	0.30 J	0.38 J	0.57 J	0.28 J	0.11 J	ND(0.03)	0.97 J
Zinc	mg/kg	633 J	445 J	338 J	100 J	321 J	559 J	147 J	47.9 J	32.3 J	835 J
TOTAL PETROLEUM HYDROCARBONS											
Bunker C	mg/kg	ND(64)	ND(130)	ND(72)	ND(5.9)	ND(55)	ND(310)	ND(25)	ND(4.7)	ND(4.5)	ND(130)
Diesel Fuel	mg/kg	260 J	470 J	340 J	21 J	410 J	1300 J	190 J	21 J	ND(0.81)	910 J
Fuel Oil 4 & 5	mg/kg	ND(64)	ND(130)	ND(72)	ND(5.9)	ND(55)	ND(310)	ND(25)	ND(4.7)	ND(4.5)	ND(130)
Hydraulc Fluid	mg/kg	ND(64)	ND(130)	ND(72)	ND(5.9)	ND(55)	ND(310)	ND(25)	ND(4.7)	ND(4.5)	ND(130)
Jet A	mg/kg	ND(65)	ND(130)	ND(73)	ND(5.9)	ND(56)	ND(320)	ND(25)	ND(4.7)	ND(4.5)	ND(130)
JP4	mg/kg	ND(64)	ND(130)	ND(72)	ND(5.9)	ND(55)	ND(310)	ND(25)	ND(4.7)	ND(4.5)	ND(130)
JP5	mg/kg	ND(64)	ND(130)	ND(72)	ND(5.9)	ND(55)	ND(310)	ND(25)	ND(4.7)	ND(4.5)	ND(130)
JP8	mg/kg	ND(64)	ND(130)	ND(72)	ND(5.9)	ND(55)	ND(310)	ND(25)	ND(4.7)	ND(4.5)	ND(130)
Kerosene	mg/kg	ND(64)	ND(130)	ND(72)	ND(5.9)	ND(55)	ND(310)	ND(25)	ND(4.7)	ND(4.5)	ND(130)
Mineral Spirits	mg/kg	ND(64)	ND(130)	ND(72)	ND(5.9)	ND(55)	ND(310)	ND(25)	ND(4.7)	ND(4.5)	ND(130)
Motor Oil	mg/kg	920 J	1500 J	1200 J	66 J	1300 J	3700 J	630 J	36 J	ND(4.7)	2600 J
Gasoline	ug/kg	ND(660)	ND(640)	ND(740)	ND(600)	ND(570)	ND(650)	ND(510)	ND(480)	ND(460)	860 J
PESTICIDES											
4,4'-DDE	ug/kg	ND(1,100)	ND(1,500)	ND(420)	ND(85)	ND(270)	ND(300)	ND(170)	ND(2.3)	ND(2.2)	ND(1,900)
4,4'-DDT	ug/kg	ND(4.3)	ND(4.2)	ND(4.8)	ND(3.9)	ND(3.7)	ND(4.2)	ND(3.3)	ND(3.1)	ND(3.0)	ND(4.4)
4,4'-TDE/DDD	ug/kg	ND(3.5)	ND(3.4)	ND(3.9)	ND(3.2)	ND(3.0)	ND(340)	ND(2.7)	ND(2.5)	ND(2.4)	ND(3.6)
alpha-Chlordane	ug/kg	ND(1,400)	ND(2,000)	ND(550)	ND(110)	ND(350)	ND(400)	ND(220)	ND(3.0)	ND(2.8)	ND(2,500)
Dieldrin	ug/kg	ND(750)	ND(1,000)	ND(290)	ND(59)	ND(180)	ND(210)	ND(110)	ND(31)	ND(1.5)	ND(1,300)
gamma-Chlordane	ug/kg	ND(1,400)	ND(2,000)	ND(550)	ND(110)	ND(350)	ND(400)	ND(220)	ND(3.0)	ND(2.8)	ND(2,500)
POLYCHLORINATED BIPHENYLS (PCBs) - Congener Method											
PCB-8	ug/Kg	ND(0.39)	ND(3.8)	15	ND(0.09)	ND(0.08)	ND(0.10)	ND(0.07)	ND(0.07)	ND(0.07)	ND(0.10)
PCB-18	ug/Kg	ND(0.31)	ND(3.0)	ND(0.35)	ND(0.07)	ND(0.07)	ND(0.08)	ND(0.06)	ND(0.06)	ND(0.05)	ND(0.08)
PCB-28	ug/Kg	ND(0.16)	ND(1.5)	ND(0.17)	ND(0.04)	ND(0.03)	190 J	ND(0.03)	ND(0.03)	ND(0.03)	ND(0.04)
PCB-44	ug/Kg	59 J	330 J	33 J	1.7 J	17 J	250 J	17 J	ND(0.01)	ND(0.01)	430 J
PCB-52	ug/Kg	140 J	830 J	90 J	4.8 J	100 J	670 J	390 J	12 J	3.1 J	920 J
PCB-66	ug/Kg	200 J	1100 J	130 J	6.1 J	61 J	650 J	64 J	3.3 J	ND(0.01)	1200 J
PCB-77	ug/Kg	ND(0.47	1400 J	ND(0.52)	ND(0.11)	ND(0.10)	ND(0.11)	ND(0.09)	ND(0.09)	ND(0.08)	ND(0.12)
PCB-81	ug/Kg	ND(0.47	ND(4.5)	ND(0.52)	ND(0.11)	ND(0.10)	ND(0.11)	ND(0.09)	ND(0.09)	ND(0.08)	ND(0.12)
PCB-101	ug/Kg	330 J	1700 J	220 J	8.3 J	140 J	1000 J	200 J	8.8 J	1.1 J	1900 J
PCB-105	ug/Kg	95	460 J	65	2.6	35	320	ND(0.01)	ND(0.01)	ND(0.01)	590
PCB-114	ug/Kg	ND(0.08)	ND(0.76)	ND(0.09)	ND(0.02)	ND(0.02)	ND(0.02)	240 J	6.2 J	1.5 J	ND(0.02)

Table C-3 Analytical Data (E&E, 2009).

Location ID:		YC-032	YC-032	YC-032	YC-032	YC-033	YC-033	YC-033	YC-033	YC-033	YC-034
Depth Interval (ft):		1 - 2	2 - 3	3 - 4	4 - 5	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	0 - 1
Sample Date:	Units:	7/7/2009	7/7/2009	7/7/2009	7/7/2009	7/8/2009	7/8/2009	7/8/2009	7/8/2009	7/8/2009	7/8/2009
METALS											
Chromium	mg/kg	443 J	47.6 J	47.0 J	40.2 J	103 J	185 J	253 J	179 J	94.5 J	117 J
Lead	mg/kg	882 J	56.6 J	4.4 J	3.5 J	179 J	912 J	532 J	343 J	58.5 J	221 J
Mercury	mg/kg	0.84 J	0.12 J	0.042 J	ND(0.03)	0.46 J	0.73 J	0.48 J	0.62 J	0.23 J	0.56 J
Zinc	mg/kg	828 J	68.0 J	32.9 J	45.8 J	209 J	540 J	507 J	453 J	132 J	356 J
TOTAL PETROLEUM HYDROCARBONS											
Bunker C	mg/kg	ND(130)	ND(4.2)	ND(4.0)	ND(4.3)	ND(56)	ND(100)	ND(29)	ND(62)	ND(5.8)	ND(6.1)
Diesel Fuel	mg/kg	2800 J	88 J	14 J	ND(0.78)	57 J	650	210	410	25 J	97
Fuel Oil 4 & 5	mg/kg	ND(130)	ND(4.2)	ND(4.0)	ND(4.3)	ND(56)	ND(100)	ND(29)	ND(62)	ND(5.8)	ND(6.1)
Hydraulc Fluid	mg/kg	ND(130)	ND(4.2)	ND(4.0)	ND(4.3)	ND(5.7)	ND(100)	ND(29)	ND(62)	ND(5.8)	ND(6.1)
Jet A	mg/kg	ND(130)	ND(4.2)	ND(4.1)	ND(4.3)	ND(57)	ND(110)	ND(29)	ND(62)	ND(5.9)	ND(6.2)
JP4	mg/kg	ND(130)	ND(4.2)	ND(4.0)	ND(4.3)	ND(56)	ND(100)	ND(29)	ND(62)	ND(5.8)	ND(6.1)
JP5	mg/kg	ND(130)	ND(4.2)	ND(4.0)	ND(4.3)	ND(56)	ND(100)	ND(29)	ND(62)	ND(5.8)	ND(6.1)
JP8	mg/kg	ND(130)	ND(4.2)	ND(4.0)	ND(4.3)	ND(5.7)	ND(100)	ND(29)	ND(62)	ND(5.8)	ND(6.1)
Kerosene	mg/kg	ND(130)	ND(4.2)	ND(4.0)	ND(4.3)	ND(5.7)	ND(100)	ND(29)	ND(62)	ND(5.8)	ND(6.1)
Mineral Spirits	mg/kg	ND(130)	ND(4.2)	ND(4.0)	ND(4.3)	ND(56)	ND(100)	ND(29)	ND(62)	ND(5.8)	ND(6.1)
Motor Oil	mg/kg	5000 J	290 J	22 J	ND(4.6)	190 J	1600	510	900	52 J	330 J
Gasoline	ug/kg	6200 J	710 J	ND(420)	ND(440)	ND(580)	1200	3600 J	2800	ND(600)	ND(630)
PESTICIDES											
4,4'-DDE	ug/kg	ND(4,500)	ND(100)	ND(39)	ND(2.1)	ND(140)	ND(510)	ND(340)	ND(300)	ND(57)	ND(150)
4,4'-DDT	ug/kg	ND(88)	ND(2.8)	ND(2.7)	ND(2.9)	ND(3.8)	ND(3.5)	ND(470)	ND(410)	ND(3.9)	ND(4.1)
4,4'-TDE/DDD	ug/kg	ND(72)	ND(2.3)	ND(2.2)	ND(2.3)	ND(3.1)	ND(2.8)	ND(3.2)	ND(3.4)	ND(3.2)	ND(3.3)
alpha-Chlordane	ug/kg	ND(5,900)	ND(130)	ND(2.6)	ND(2.7)	ND(3.6)	ND(660)	ND(450)	ND(390)	ND(3.7)	ND(190)
Dieldrin	ug/kg	ND(3,100)	ND(70)	ND(27)	ND(1.4)	ND(95)	ND(350)	ND(230)	ND(210)	ND(1.9)	ND(100)
gamma-Chlordane	ug/kg	ND(5,900)	ND(130)	ND(2.6)	ND(2.7)	ND(180)	ND(660)	ND(450)	ND(390)	ND(3.7)	ND(190)
POLYCHLORINATED BIPHENYLS (PCBs) - Congener Method											
PCB-8	ug/Kg	ND(10)	2.5	ND(0.06)	ND(0.07)	1.7	6.7	1.9	3.2 J	ND(0.09)	ND(0.09)
PCB-18	ug/Kg	ND(8.0)	ND(0.05)	ND(0.05)	ND(0.05)	ND(0.09)	29	ND(0.07)	ND(1.5)	ND(0.07)	ND(0.07)
PCB-28	ug/Kg	ND(4.0)	ND(0.03)	ND(0.03)	ND(0.03)	1.5	15	ND(0.04)	ND(0.75)	1.1	ND(0.04)
PCB-44	ug/Kg	560 J	12 J	1.3 J	ND(0.01)	3.9 J	18 J	11 J	16 J	ND(0.02)	2.1 J
PCB-52	ug/Kg	1300 J	29 J	5.2 J	ND(0.01)	6.0 J	58 J	49 J	45 J	0.86 J	4.9 J
PCB-66	ug/Kg	490 J	39 J	4.0 J	ND(0.01)	10 J	47 J	42 J	66 J	ND(0.02)	9.0 J
PCB-77	ug/Kg	ND(12)	13	0.9	ND(0.08)	23 J	73 J	47 J	ND(2.2)	ND(0.11)	21 J
PCB-81	ug/Kg	ND(12)	ND(0.08)	ND(0.07)	ND(0.08)	35	ND(0.10)	ND(0.11)	ND(2.2)	ND(0.11)	ND(0.11)
PCB-101	ug/Kg	3200 J	63 J	6.6 J	ND(0.01)	18 J	75 J	63 J	85 J	ND(0.02)	15 J
PCB-105	ug/Kg	1300	22	1.8	ND(0.01)	6.5 J	20 J	14 J	32 J	ND(0.02)	6.4 J
PCB-114	ug/Kg	ND(2.0)	ND(0.01)	ND(0.01)	ND(0.01)	28 J	46 J	33 J	57 J	ND(0.02)	12 J

Table C-3 Analytical Data (E&E, 2009).

Location ID: / Depth Interval (ft): / Sample Date:	Units:	YC-034 1 - 2 7/8/2009	YC-034 2 - 3 7/8/2009	YC-034 3 - 4 7/8/2009	YC-034 4 - 5 7/8/2009	YC-035 0 - 1 7/8/2009	YC-035 1 - 2 7/8/2009	YC-035 2 - 3 7/8/2009	YC-035 3 - 4 7/8/2009	YC-035 4 - 5 7/8/2009
METALS										
Chromium	mg/kg	176 J	360 J	114 J	61.9 J	133 J	160 J	114 J	116 J	57.2 J
Lead	mg/kg	625 J	578 J	104 J	7.9 J	225 J	484 J	482 J	243 J	22.7 J
Mercury	mg/kg	0.85 J	1.2 J	0.50 J	0.063 J	0.60 J	0.65 J	0.34 J	0.47 J	0.18 J
Zinc	mg/kg	436 J	564 J	201 J	59.7 J	302 J	359 J	257 J	320 J	64.1 J
TOTAL PETROLEUM HYDROCARBONS										
Bunker C	mg/kg	ND(5.0)	ND(6.6)	ND(5.9)	ND(5.3)	ND(11)	ND(13)	ND(47)	ND(51)	ND(4.9)
Diesel Fuel	mg/kg	170 J	460 J	55	7.2	260 J	180	190	99	27
Fuel Oil 4 & 5	mg/kg	ND(5.0)	ND(6.6)	ND(5.9)	ND(5.3)	ND(11)	ND(13)	ND(47)	ND(51)	ND(4.9)
Hydraulc Fluid	mg/kg	ND(5.0)	ND(6.6)	ND(5.9)	ND(5.3)	ND(11)	ND(13)	ND(47)	ND(51)	ND(4.9)
Jet A	mg/kg	ND(5.1)	6.7	ND(5.9)	ND(5.4)	ND(11)	ND(13)	ND(47)	ND(51)	ND(5.0)
JP4	mg/kg	ND(5.0)	ND(6.6)	ND(5.9)	ND(5.3)	ND(11)	ND(13)	ND(47)	ND(51)	ND(4.9)
JP5	mg/kg	ND(5.0)	ND(6.6)	ND(5.9)	ND(5.3)	ND(11)	ND(13)	ND(47)	ND(51)	ND(4.9)
JP8	mg/kg	ND(5.0)	ND(6.6)	ND(5.9)	ND(5.3)	ND(11)	ND(13)	ND(47)	ND(51)	ND(4.9)
Kerosene	mg/kg	ND(5.0)	ND(6.6)	ND(5.9)	ND(5.3)	ND(11)	ND(13)	ND(47)	ND(51)	ND(4.9)
Mineral Spirits	mg/kg	ND(5.0)	ND(6.6)	ND(5.9)	ND(5.3)	ND(11)	ND(13)	ND(47)	ND(51)	ND(4.9)
Motor Oil	mg/kg	760 J	1700 J	210 J	17	1300 J	710 J	780	540	57
Gasoline	ug/kg	650 J	16000 J	ND(600)	ND(550)	1700	ND(670)	730	ND(520)	ND(510)
PESTICIDES										
4,4'-DDE	ug/kg	ND(360)	ND(1,600)	ND(57)	ND(2.6)	ND(330)	ND(630)	ND(1,600)	ND(120)	ND(2.4)
4,4'-DDT	ug/kg	ND(3.3)	ND(44)	ND(3.9)	ND(3.5)	ND(3.8)	ND(860)	ND(31)	ND(3.4)	ND(3.3)
4,4'-TDE/DDD	ug/kg	ND(2.7)	ND(36)	ND(3.2)	ND(2.9)	ND(370)	ND(710)	ND(25)	ND(2.8)	ND(2.7)
alpha-Chlordane	ug/kg	ND(480)	ND(2,100)	ND(3.7)	ND(3.4)	ND(3.6)	ND(820)	ND(30)	ND(160)	ND(3.1)
Dieldrin	ug/kg	ND(250)	ND(1,100)	ND(39)	ND(1.8)	ND(230)	ND(430)	ND(1,100)	ND(84)	ND(33)
gamma-Chlordane	ug/kg	ND(480)	ND(42)	ND(3.7)	ND(3.4)	ND(430)	ND(820)	ND(30)	ND(160)	ND(3.1)
POLYCHLORINATED BIPHENYLS (PCBs) - Congener Method										
PCB-8	ug/Kg	11 J	ND(10)	1.7	ND(0.08)	2.4	17	20 J	2	ND(0.07)
PCB-18	ug/Kg	ND(1.2)	41 J	ND(0.07)	ND(0.07)	ND(0.07)	110	110 J	ND(0.06)	ND(0.06)
PCB-28	ug/Kg	ND(0.61)	490	ND(0.04)	ND(0.03)	ND(0.03)	60	300 J	18	ND(0.03)
PCB-44	ug/Kg	49 J	38 J	1.1 J	ND(0.02)	2.8 J	86 J	250 J	23 J	1.6 J
PCB-52	ug/Kg	240 J	1100 J	23 J	ND(0.02)	6.6 J	180 J	1300 J	180 J	11 J
PCB-66	ug/Kg	150 J	240 J	5.7 J	ND(0.02)	9.0 J	190 J	1100 J	140 J	5.4 J
PCB-77	ug/Kg	190 J	610 J	ND(0.11)	ND(0.10)	5.9 J	76	ND(8.5)	ND(0.09)	ND(0.09)
PCB-81	ug/Kg	ND(1.8)	ND(12)	ND(0.11)	ND(0.10)	ND(0.10)	ND(2.4)	ND(8.5)	ND(0.09)	ND(0.09)
PCB-101	ug/Kg	210 J	630 J	14 J	ND(0.02)	17 J	290 J	1900 J	210 J	7.9 J
PCB-105	ug/Kg	46 J	19 J	2.1 J	ND(0.02)	6.1 J	87 J	510 J	54 J	1.4 J
PCB-114	ug/Kg	ND(0.30)	850 J	12 J	ND(0.02)	11 J	100 J	2200 J	ND(0.01)	9.0 J

Table C-3 Analytical Data (E&E, 2009).

Location ID:		YC-036	YC-036	YC-036	YC-036
Depth Interval (ft):		0 - 1	1 - 2	2 - 3	3 - 4
Sample Date:	Units:	7/9/2009	7/9/2009	7/9/2009	7/9/2009
METALS					
Chromium	mg/kg	189 J	250 J	252 J	38.4 J
Lead	mg/kg	396 J	370 J	382 J	5.7 J
Mercury	mg/kg	1.0 J	0.74 J	0.25 J	0.087 J
Zinc	mg/kg	394 J	296 J	300 J	37.3 J
TOTAL PETROLEUM HYDROCARBONS					
Bunker C	mg/kg	ND(63)	ND(54)	ND(45)	ND(4.1)
Diesel Fuel	mg/kg	180	290	140	23
Fuel Oil 4 & 5	mg/kg	ND(63)	ND(54)	ND(44)	ND(4.1)
Hydraulc Fluid	mg/kg	ND(63)	ND(54)	ND(45)	ND(4.1)
Jet A	mg/kg	ND(64)	ND(55)	ND(44)	ND(4.1)
JP4	mg/kg	ND(63)	ND(54)	ND(44)	ND(4.1)
JP5	mg/kg	ND(63)	ND(54)	ND(45)	ND(4.1)
JP8	mg/kg	ND(63)	ND(54)	ND(44)	ND(4.1)
Kerosene	mg/kg	ND(63)	ND(54)	ND(44)	ND(4.1)
Mineral Spirits	mg/kg	ND(63)	ND(54)	ND(45)	ND(4.1)
Motor Oil	mg/kg	830	1400	750	42
Gasoline	ug/kg	ND(650)	ND(560)	ND(470)	ND(420)
PESTICIDES					
4,4'-DDE	ug/kg	ND(1,200)	ND(1,600)	ND(110)	ND(2.0)
4,4'-DDT	ug/kg	ND(4.2)	ND(36)	ND(3.0)	ND(2.7)
4,4'-TDE/DDD	ug/kg	ND(3.5)	ND(29)	ND(500)	ND(2.2)
alpha-Chlordane	ug/kg	ND(1,600)	ND(2,100)	ND(2.8)	ND(2.6)
Dieldrin	ug/kg	ND(850)	ND(1,100)	ND(300)	ND(1.4)
gamma-Chlordane	ug/kg	ND(1,600)	ND(2,100)	ND(580)	ND(2.6)
POLYCHLORINATED BIPHENYLS (PCBs) - Congener Method					
PCB-8	ug/Kg	ND(3.8)	30 J	ND(0.07)	ND(0.06)
PCB-18	ug/Kg	ND(3.1)	130	ND(0.06)	ND(0.05)
PCB-28	ug/Kg	59 J	32 J	ND(0.03)	ND(0.03)
PCB-44	ug/Kg	310 J	250 J	8.1 J	0.72 J
PCB-52	ug/Kg	740 J	610 J	23 J	1.8 J
PCB-66	ug/Kg	880 J	1100 J	99 J	2.4 J
PCB-77	ug/Kg	260 J	ND(9.8)	36 J	ND(0.07)
PCB-81	ug/Kg	1500 J	ND(9.8)	ND(0.08)	ND(0.07)
PCB-101	ug/Kg	1300 J	1500 J	110 J	4.0 J
PCB-105	ug/Kg	4.5 J	640 J	27 J	1.2 J
PCB-114	ug/Kg	480 J	1000 J	53 J	ND(0.01)

Table C-3 Analytical Data (E&E, 2009).

Location ID:		YC-001	YC-001	YC-001	YC-001	YC-002	YC-002	YC-002	YC-002	YC-002	YC-003
Depth Interval (ft):		0 - 1	1 - 2	2 - 3	3 - 4	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	0 - 1
Sample Date:	Units:	7/1/2009	7/1/2009	7/1/2009	7/1/2009	7/1/2009	7/1/2009	7/1/2009	7/1/2009	7/1/2009	6/29/2009
PCB-118	ug/Kg	ND(0.01)	ND(0.01)	ND(0.02)	4.7 J	3.9 J	350 J	9.3 J	ND(0.02)	ND(0.01)	120 J
PCB-123	ug/Kg	0.68 J	ND(0.06)	ND(0.10)	ND(0.11)	2.6	ND(0.09)	ND(0.07)	ND(0.08)	ND(0.07)	ND(0.08)
PCB-126	ug/Kg	ND(0.07)	ND(0.06)	ND(0.10)	ND(0.11)	ND(0.12)	ND(0.09)	ND(0.07)	ND(0.08)	ND(0.07)	ND(0.08)
PCB-128	ug/Kg	ND(0.01)	ND(0.01)	ND(0.02)	1.4 J	ND(0.02)	59 J	7.7 J	ND(0.02)	ND(0.01)	26 J
PCB-138	ug/Kg	1.5	ND(0.01)	1.2 J	7.4 J	7.7 J	800 J	14 J	2.9 J	ND(0.01)	230 J
PCB-153	ug/Kg	1.8 J	ND(0.01)	ND(0.02)	6.4 J	9.9 J	900 J	16 J	3.7 J	ND(0.01)	260 J
PCB-156	ug/Kg	ND(0.07)	ND(0.06)	ND(0.10)	8.6	3.9	ND(0.09)	14	ND(0.08)	ND(0.07)	ND(0.08)
PCB-157	ug/Kg	2.1	ND(0.06)	1.1	ND(0.11)	ND(0.12)	ND(0.09)	ND(0.07)	ND(0.08)	ND(0.07)	ND(0.08)
PCB-167	ug/Kg	ND(0.07)	ND(0.06)	ND(0.10)	ND(0.11)	ND(0.12)	35	ND(0.07)	ND(0.08)	ND(0.07)	ND(0.08)
PCB-169	ug/Kg	2.0 J	ND(0.08)	ND(0.11)	2.0 J	ND(0.14)	170 J	7.1 J	ND(0.09)	ND(0.09)	34 J
PCB-170	ug/Kg	2	ND(0.01)	ND(0.02)	5.9	2.6	510	8.2	1.6	ND(0.01)	130 J
PCB-180	ug/Kg	2	ND(0.01)	1.1	9.2	4.1	840	14	3.1	ND(0.01)	210 J
PCB-187	ug/Kg	1.7	ND(0.01)	ND(0.02)	5.6	4.8	440	6.2	1.8	ND(0.01)	110 J
PCB-189	ug/Kg	0.47 J	ND(0.06)	ND(0.10)	1.2	ND(0.12)	10	ND(0.07)	ND(0.08)	ND(0.07)	4.3
PCB-195	ug/Kg	ND(0.01)	ND(0.01)	ND(0.02)	1.2	ND(0.02)	37	1.2	ND(0.02)	ND(0.01)	19
PCB-206	ug/Kg	1.8	ND(0.01)	ND(0.02)	0.8 J	ND(0.02)	16	0.77	ND(0.02)	ND(0.01)	8.3
PCB-209	ug/Kg	ND(0.01)	ND(0.01)	ND(0.02)	ND(0.02)	ND(0.02)	4	ND(0.01)	ND(0.02)	ND(0.01)	2.6
Total PCBs (18 congeners)	ug/Kg	12	ND(0.08)	2.3	89	40	5,450	117	17	ND(0.09)	1,521
Total PCBs (28 congeners)	ug/kg	17	ND(0.08)	4.0	100	54	6,865	148	20	ND(0.09)	1,648
POLYCHLORINATED BIPHENYLS (PCBs) - Aroclor Method											
Aroclor 1016	ug/kg	ND(15)	ND(13)	ND(19)	ND(21)	ND(23)	ND(17)	ND(13)	ND(15)	ND(15)	ND(15)
Aroclor 1221	ug/kg	ND(6.0)	ND(5.1)	ND(7.6)	ND(8.7)	ND(9.5)	ND(7.1)	ND(5.3)	ND(6.3)	ND(6.0)	ND(6.1)
Aroclor 1232	ug/kg	ND(6.0)	ND(5.1)	ND(7.6)	ND(8.7)	ND(9.5)	ND(7.1)	ND(5.3)	ND(6.3)	ND(6.0)	ND(6.1)
Aroclor 1242	ug/kg	ND(3.9)	ND(3.3)	ND(5.0)	ND(5.7)	ND(6.2)	ND(4.6)	ND(3.4)	ND(4.1)	ND(3.9)	ND(3.9)
Aroclor 1248	ug/kg	ND(2.1)	ND(1.8)	ND(2.7)	ND(3.0)	ND(3.3)	ND(2.5)	ND(1.8)	ND(2.2)	ND(2.1)	ND(2.1)
Aroclor 1254	ug/kg	ND(2.4)	ND(2.1)	ND(3.0)	300 J	600 J	7000 J	640 J	ND(2.5)	ND(2.4)	13000 J
Aroclor 1260	ug/kg	ND(5.4)	ND(4.6)	ND(6.9)	ND(7.8)	ND(8.6)	4700 J	400 J	ND(5.7)	ND(5.4)	6600 J
Total PCBs (Aroclor method)	ug/kg	ND(6.0)	ND(5.1)	ND(7.6)	300	600	11700	1040	ND(6.3)	ND(6.0)	19600
POLYCHLORINATED BIPHENYLS (PCBs) - Calculated Method											
Total PCBs (Calculated	ug/kg	41 E	ND (0.01) E	10 E	240 E	130 E	16,000 E	400 E [340	46 E	ND (0.01) E	3,900 E

Table C-3 Analytical Data (E&E, 2009).

Location ID:		YC-003	YC-003	YC-003	YC-003	YC-004	YC-004	YC-004	YC-005	YC-005	YC-005
Depth Interval (ft):		1 - 2	2 - 3	3 - 4	4 - 5	0 - 1	1 - 2	2 - 3	0 - 1	1 - 2	2 - 3
Sample Date:	Units:	6/29/2009	6/29/2009	6/29/2009	6/29/2009	7/2/2009	7/2/2009	7/2/2009	7/7/2009	7/7/2009	7/7/2009
PCB-118	ug/Kg	8.9 J	ND(0.01)	ND(0.01)	ND(0.02)	21 J	380 J	2.7 J	410 J	940 J	21 J
PCB-123	ug/Kg	6.2	0.37 J	ND(0.06)	ND(0.09)	ND(0.13)	ND(0.11)	ND(0.07)	ND(0.73)	ND(1.6)	ND(0.06)
PCB-126	ug/Kg	ND(0.10)	ND(0.08)	ND(0.06)	ND(0.09)	ND(0.13)	ND(0.11)	ND(0.07)	ND(0.73)	ND(1.6)	ND(0.06)
PCB-128	ug/Kg	ND(0.02)	ND(0.01)	ND(0.01)	ND(0.02)	13 J	81 J	ND(0.01)	150 J	310 J	9.3 J
PCB-138	ug/Kg	13 J	0.59 J	ND(0.01)	ND(0.02)	41 J	810 J	4.4 J	490 J	1100 J	31 J
PCB-153	ug/Kg	15 J	ND(0.01)	ND(0.01)	ND(0.02)	41 J	930 J	5.2 J	440 J	950 J	26 J
PCB-156	ug/Kg	13	0.47 J	ND(0.06)	ND(0.09)	ND(0.13)	140 J	ND(0.07)	ND(0.73)	ND(1.6)	ND(0.06)
PCB-157	ug/Kg	15	0.53 J	ND(0.06)	ND(0.09)	25 J	730 J	ND(0.07)	280 J	570 J	19 J
PCB-167	ug/Kg	1.3	ND(0.08)	ND(0.06)	ND(0.09)	ND(0.13)	ND(0.11)	ND(0.07)	ND(0.73)	ND(1.6)	ND(0.06)
PCB-169	ug/Kg	ND(0.12)	ND(0.09)	ND(0.08)	ND(0.11)	ND(0.16)	170 J	ND(0.08)	ND(0.88)	ND(1.9)	ND(0.08)
PCB-170	ug/Kg	8.1	ND(0.01)	ND(0.01)	ND(0.02)	18 J	440 J	3.1 J	170 J	370 J	15 J
PCB-180	ug/Kg	14	0.50 J	ND(0.01)	ND(0.02)	25 J	740 J	3.4 J	280 J	580 J	19 J
PCB-187	ug/Kg	6.6	ND(0.01)	ND(0.01)	ND(0.02)	16 J	350 J	2.6 J	150 J	260 J	8.7 J
PCB-189	ug/Kg	ND(0.10)	ND(0.08)	ND(0.06)	ND(0.09)	ND(0.13)	37 J	ND(0.07)	ND(0.73)	ND(1.6)	ND(0.06)
PCB-195	ug/Kg	1.2	ND(0.01)	ND(0.01)	ND(0.02)	3.0 J	70 J	ND(0.01)	27 J	58 J	ND(0.01)
PCB-206	ug/Kg	0.70 J	ND(0.01)	ND(0.01)	ND(0.02)	ND(0.03)	23 J	ND(0.01)	15 J	ND(0.31)	ND(0.01)
PCB-209	ug/Kg	ND(0.02)	ND(0.01)	ND(0.01)	ND(0.02)	ND(0.03)	13	ND(0.01)	17 J	20 J	ND(0.01)
Total PCBs (18 congeners)	ug/Kg	104	1	ND(0.08)	ND(0.11)	254	5,530	28	3,896	8,587	225
Total PCBs (28 congeners)	ug/kg	151	2	ND(0.08)	ND(0.11)	279	6,607	28	4,176	9,157	244
POLYCHLORINATED BIPHENYLS (PCBs) - Aroclor Method											
Aroclor 1016	ug/kg	ND(19)	ND(15)	ND(12)	ND(18)	ND(26)	ND(21)	ND(13)	ND(14)	ND(15)	ND(13)
Aroclor 1221	ug/kg	ND(7.8)	ND(6.1)	ND(5.0)	ND(7.4)	ND(11)	ND(8.6)	ND(5.4)	ND(5.8)	ND(6.3)	ND(5.1)
Aroclor 1232	ug/kg	ND(7.8)	ND(6.1)	ND(5.0)	ND(7.4)	ND(11)	ND(8.6)	ND(5.4)	ND(5.8)	ND(6.3)	ND(5.1)
Aroclor 1242	ug/kg	ND(5.1)	ND(4.0)	ND(3.3)	ND(4.8)	ND(7.0)	ND(5.6)	ND(3.5)	ND(3.8)	ND(4.1)	ND(3.3)
Aroclor 1248	ug/kg	ND(2.7)	ND(2.1)	ND(1.8)	ND(2.6)	ND(3.7)	ND(3.0)	ND(1.9)	ND(2.0)	ND(2.2)	ND(1.8)
Aroclor 1254	ug/kg	390 J	ND(2.4)	ND(2.0)	ND(3.0)	2300 J	11000 J	160 J	17000 J	45000 J	1000 J
Aroclor 1260	ug/kg	ND(7.0)	ND(5.5)	ND(4.5)	ND(6.7)	ND(9.6)	ND(7.7)	ND(4.8)	ND(5.3)	ND(5.6)	ND(4.6)
Total PCBs (Aroclor method)	ug/kg	390	ND(6.1)	ND(5.0)	ND(7.4)	2300	11000	160	17000	45000	1000
POLYCHLORINATED BIPHENYLS (PCBs) - Calculated Method											
Total PCBs (Calculated	ug/kg	220 E [360	5 E	ND (0.01) E	ND (0.01) E	660 E	16,000 E	67 E	9,900 E	29,000 E	580 E

Table C-3 Analytical Data (E&E, 2009).

Location ID:		YC-005	YC-005	YC-006	YC-006	YC-006	YC-006	YC-006	YC-007	YC-007	YC-007
Depth Interval (ft):		3 - 4	4 - 5	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	0 - 1	1 - 2	2 - 3
Sample Date:	Units:	7/7/2009	7/7/2009	6/29/2009	6/29/2009	6/29/2009	6/29/2009	6/29/2009	7/7/2009	7/7/2009	7/7/2009
PCB-118	ug/Kg	0.78 J	ND(0.02)	9.9	110	8.3	5.5	ND(0.01)	710 J	14 J	1.9 J
PCB-123	ug/Kg	ND(0.07)	ND(0.08)	ND(0.12)	ND(0.10)	ND(0.07)	ND(0.06)	ND(0.06)	ND(10)	ND(1.3)	ND(0.07)
PCB-126	ug/Kg	ND(0.07)	ND(0.08)	ND(0.12)	ND(0.10)	ND(0.07)	ND(0.06)	ND(0.06)	ND(10)	ND(1.3)	ND(0.07)
PCB-128	ug/Kg	ND(0.01)	ND(0.02)	2.9 J	30 J	5.6 J	1.5 J	ND(0.01)	180 J	ND(0.27)	ND(0.01)
PCB-138	ug/Kg	1.2 J	ND(0.02)	15 J	240 J	14 J	9.6 J	1.5 J	660 J	29 J	2.1 J
PCB-153	ug/Kg	ND(0.01)	ND(0.02)	16 J	310 J	18 J	13 J	1.9 J	1100 J	88 J	4.5 J
PCB-156	ug/Kg	ND(0.07)	ND(0.08)	1.7 J	ND(0.10)	1.8 J	1.2 J	ND(0.06)	ND(10)	ND(1.3)	ND(0.07)
PCB-157	ug/Kg	ND(0.07)	ND(0.08)	ND(0.12)	ND(0.10)	ND(0.07)	ND(0.06)	ND(0.06)	390 J	29 J	ND(0.07)
PCB-167	ug/Kg	ND(0.07)	ND(0.08)	ND(0.12)	ND(0.10)	ND(0.07)	ND(0.06)	ND(0.06)	ND(10)	ND(1.3)	ND(0.07)
PCB-169	ug/Kg	ND(0.09)	ND(0.10)	ND(0.14)	ND(0.11)	ND(0.08)	ND(0.08)	ND(0.07)	ND(13)	ND(1.6)	ND(0.08)
PCB-170	ug/Kg	ND(0.01)	ND(0.02)	7.8 J	170 J	8.5 J	6.0 J	0.98 J	270 J	17 J	ND(0.01)
PCB-180	ug/Kg	ND(0.01)	ND(0.02)	12 J	280 J	15 J	10 J	1.6 J	400 J	29 J	1.6 J
PCB-187	ug/Kg	ND(0.01)	ND(0.02)	8.2 J	150 J	8.4 J	6.0 J	0.92 J	350 J	33 J	1.5 J
PCB-189	ug/Kg	ND(0.07)	ND(0.08)	ND(0.12)	ND(0.10)	ND(0.07)	ND(0.06)	ND(0.06)	ND(10)	ND(1.3)	ND(0.07)
PCB-195	ug/Kg	ND(0.01)	ND(0.02)	1.2 J	23 J	1.2 J	0.92 J	0.16 J	47 J	ND(0.27)	ND(0.01)
PCB-206	ug/Kg	ND(0.01)	ND(0.02)	ND(0.02)	11 J	ND(0.01)	ND(0.01)	ND(0.01)	22 J	ND(0.27)	ND(0.01)
PCB-209	ug/Kg	ND(0.01)	ND(0.02)	ND(0.02)	4.7	ND(0.01)	ND(0.01)	ND(0.01)	ND(2.1)	ND(0.27)	ND(0.01)
Total PCBs (18 congeners)	ug/Kg	2	ND(0.10)	100	1,755	115	74	8	6,889	311	22
Total PCBs (28 congeners)	ug/kg	2	ND(0.10)	101	1,755	117	76	8	8,119	404	26
POLYCHLORINATED BIPHENYLS (PCBs) - Aroclor Method											
Aroclor 1016	ug/kg	ND(14)	ND(16)	ND(23)	ND(19)	ND(14)	ND(12)	ND(12)	ND(21)	ND(13)	ND(14)
Aroclor 1221	ug/kg	ND(5.7)	ND(6.6)	ND(9.5)	ND(7.6)	ND(5.6)	ND(5.0)	ND(4.9)	ND(8.4)	ND(5.4)	ND(5.5)
Aroclor 1232	ug/kg	ND(5.7)	ND(6.6)	ND(9.5)	ND(7.6)	ND(5.6)	ND(5.0)	ND(4.9)	ND(8.4)	ND(5.4)	ND(5.5)
Aroclor 1242	ug/kg	ND(3.7)	ND(4.3)	ND(6.2)	ND(4.9)	ND(3.7)	ND(3.3)	ND(3.2)	ND(5.4)	ND(3.5)	ND(3.6)
Aroclor 1248	ug/kg	ND(2.0)	ND(2.3)	ND(3.3)	ND(2.6)	ND(2.0)	ND(1.8)	ND(1.7)	ND(2.9)	ND(1.9)	ND(1.9)
Aroclor 1254	ug/kg	160 J	ND(2.6)	ND(3.8)	3700 J	ND(2.3)	ND(2.0)	ND(2.0)	18000 J	2700 J	240 J
Aroclor 1260	ug/kg	ND(5.1)	ND(5.9)	ND(8.6)	ND(6.8)	ND(5.1)	ND(4.5)	ND(4.4)	ND(7.5)	2100	ND(5.0)
Total PCBs (Aroclor method)	ug/kg	160	ND(6.6)	ND(9.5)	3700	ND(5.6)	ND(5.0)	ND(4.9)	18000	4800	240
POLYCHLORINATED BIPHENYLS (PCBs) - Calculated Method											
Total PCBs (Calculated	ug/kg	5 E	ND (0.01) E	240 E	4,200 E	280 E	180 E	19 E	19,000 E	960 E	37 E [62 E]

Table C-3 Analytical Data (E&E, 2009).

Location ID: Depth Interval (ft): Sample Date:	Units:	YC-007 3 - 4 7/7/2009	YC-007 4 - 5 7/7/2009	YC-008 0 - 1 7/2/2009	YC-008 1 - 2 7/2/2009	YC-008 2 - 3 7/2/2009	YC-008 3 - 4 7/2/2009	YC-008 4 - 5 7/2/2009	YC-009 0 - 1 6/25/2009	YC-009 1 - 2 6/25/2009	YC-009 2 - 3 6/25/2009
PCB-118	ug/Kg	0.53 J	0.67 J	17 J	550 J	190 J	21 J	13 J	2.7	10	130
PCB-123	ug/Kg	ND(0.06)	ND(0.06)	ND(0.09)	ND(2.3)	ND(1.0)	ND(0.11)	ND(0.08)	ND(0.11)	ND(0.09)	ND(0.07)
PCB-126	ug/Kg	ND(0.06)	ND(0.06)	ND(0.09)	ND(2.3)	ND(1.0)	ND(0.11)	ND(0.08)	ND(0.11)	ND(0.09)	ND(0.07)
PCB-128	ug/Kg	ND(0.01)	ND(0.01)	5.7 J	560 J	240 J	ND(0.02)	3.7 J	ND(0.02)	1.8 J	ND(0.01)
PCB-138	ug/Kg	0.56 J	ND(0.01)	35 J	1300 J	500 J	30 J	13 J	4.4 J	11 J	560 J
PCB-153	ug/Kg	ND(0.01)	ND(0.01)	34 J	1400 J	540 J	29 J	11 J	5.5 J	34 J	1900 J
PCB-156	ug/Kg	ND(0.06)	ND(0.06)	ND(0.09)	ND(2.3)	94 J	ND(0.11)	ND(0.08)	0.56 J	1.2 J	ND(0.07)
PCB-157	ug/Kg	ND(0.06)	ND(0.06)	ND(0.09)	1200 J	490 J	24 J	ND(0.08)	ND(0.11)	ND(0.09)	ND(0.07)
PCB-167	ug/Kg	ND(0.06)	ND(0.06)	ND(0.09)	ND(2.3)	ND(1.0)	ND(0.11)	ND(0.08)	ND(0.11)	ND(0.09)	ND(0.07)
PCB-169	ug/Kg	ND(0.07)	ND(0.07)	ND(0.11)	ND(2.7)	ND(1.3)	ND(0.13)	ND(0.09)	ND(0.14)	ND(0.10)	ND(0.08)
PCB-170	ug/Kg	ND(0.01)	ND(0.01)	15 J	710 J	300 J	15 J	3.8 J	2.4 J	6.8 J	47 J
PCB-180	ug/Kg	ND(0.01)	ND(0.01)	23 J	1200 J	490 J	24 J	6.3 J	3.8 J	11 J	100 J
PCB-187	ug/Kg	ND(0.01)	ND(0.01)	15 J	570 J	230 J	12 J	2.7 J	2.8	22 J	680 J
PCB-189	ug/Kg	ND(0.06)	ND(0.06)	ND(0.09)	ND(2.3)	ND(1.0)	ND(0.11)	ND(0.08)	ND(0.11)	ND(0.09)	ND(0.07)
PCB-195	ug/Kg	ND(0.01)	ND(0.01)	2.7 J	110 J	49 J	4.1 J	ND(0.02)	ND(0.02)	1.3 J	8.3 J
PCB-206	ug/Kg	ND(0.01)	ND(0.01)	1.9 J	50 J	22 J	3.2 J	ND(0.02)	ND(0.02)	1.5 J	21 J
PCB-209	ug/Kg	ND(0.01)	ND(0.01)	2.3 J	ND(0.46)	ND(0.21)	3.8 J	2.1 J	ND(0.02)	ND(0.02)	ND(0.01)
Total PCBs (18 congeners)	ug/Kg	2	3	205	9,265	3,568	220	91	25	160	3,925
Total PCBs (28 congeners)	ug/kg	2	3	205	12,865	4,702	244	99	26	161	3,925
POLYCHLORINATED BIPHENYLS (PCBs) - Aroclor Method											
Aroclor 1016	ug/kg	ND(12)	ND(12)	ND(17)	ND(22)	ND(21)	ND(21)	ND(15)	ND(22)	ND(17)	ND(13)
Aroclor 1221	ug/kg	ND(4.9)	ND(4.8)	ND(7.0)	ND(9.1)	ND(8.4)		ND(6.3)	ND(9.0)	ND(6.8)	ND(5.3)
Aroclor 1232	ug/kg	ND(4.9)	ND(4.8)	ND(7.0)	ND(9.1)	ND(8.4)		ND(6.3)	ND(9.0)	ND(6.8)	ND(5.3)
Aroclor 1242	ug/kg	ND(3.2)	ND(3.1)	ND(4.6)	ND(5.9)	ND(5.5)		ND(4.1)	ND(5.9)	ND(4.4)	ND(3.4)
Aroclor 1248	ug/kg	ND(1.7)	ND(1.7)	ND(2.5)	ND(3.2)	ND(2.9)		ND(2.2)	ND(3.2)	ND(2.4)	ND(1.8)
Aroclor 1254	ug/kg	63 J	ND(1.9)	1000 J	28000 J	18000 J	2800 J	1600 J	ND(3.6)	960 J	ND(2.1)
Aroclor 1260	ug/kg	ND(4.4)	ND(4.3)	ND(6.3)	ND(8.2)	14000	ND(7.8)	ND(5.6)	ND(8.1)	ND(6.1)	ND(4.8)
Total PCBs (Aroclor method)	ug/kg	63	ND(4.8)	1000	28000	32000	2800	1600	ND(9.0)	960	ND(5.3)
POLYCHLORINATED BIPHENYLS (PCBs) - Calculated Method											
Total PCBs (Calculated	ug/kg	5 E	7 E	490 E	31,000 E	11,000 E	580 E	240 E	61 E	380 E	9,300 E

Table C-3 Analytical Data (E&E, 2009).

Location ID:		YC-009	YC-009	YC-010	YC-010	YC-010	YC-010	YC-011	YC-011	YC-011	YC-011
Depth Interval (ft):		3 - 4	4 - 5	0 - 1	1 - 2	2 - 3	3 - 4	0 - 1	1 - 2	2 - 3	3 - 4
Sample Date:	Units:	6/25/2009	6/25/2009	7/9/2009	7/9/2009	7/9/2009	7/9/2009	6/25/2009	6/25/2009	6/25/2009	6/25/2009
PCB-118	ug/Kg	0.29 J	3	1300 J	27 J	1.1 J	ND(0.01)	14	84	330 J	5.1
PCB-123	ug/Kg	ND(0.06)	ND(0.08)	2400	ND(0.07)	ND(0.07)	ND(0.06)	ND(0.10)	ND(0.10)	ND(0.10)	ND(0.07)
PCB-126	ug/Kg	ND(0.06)	ND(0.08)	ND(10)	ND(0.07)	ND(0.07)	ND(0.06)	ND(0.10)	ND(0.10)	ND(0.10)	ND(0.07)
PCB-128	ug/Kg	ND(0.01)	ND(0.02)	850 J	10 J	ND(0.01)	ND(0.01)	3.7 J	16 J	ND(0.02)	1.6 J
PCB-138	ug/Kg	ND(0.01)	3.9 J	2300 J	120 J	2.2 J	ND(0.01)	19 J	72 J	1100 J	12 J
PCB-153	ug/Kg	ND(0.01)	11 J	3900 J	190 J	3.9 J	ND(0.01)	21 J	72 J	1500 J	17 J
PCB-156	ug/Kg	ND(0.06)	0.46 J	ND(10)	12 J	ND(0.07)	ND(0.06)	ND(0.10)	10 J	ND(0.10)	ND(0.07)
PCB-157	ug/Kg	ND(0.06)	ND(0.08)	1800 J	120 J	1.9 J	ND(0.06)	15 J	ND(0.10)	ND(0.10)	ND(0.07)
PCB-167	ug/Kg	ND(0.06)	ND(0.08)	ND(10)	ND(0.07)	ND(0.07)	ND(0.06)	ND(0.10)	ND(0.10)	ND(0.10)	ND(0.07)
PCB-169	ug/Kg	ND(0.07)	ND(0.09)	ND(12)	ND(0.08)	ND(0.08)	ND(0.07)	3.7	ND(0.12)	280	2.7
PCB-170	ug/Kg	ND(0.01)	2.3 J	1100 J	54 J	1.3 J	ND(0.01)	9.1 J	25 J	840 J	9.0 J
PCB-180	ug/Kg	0.49 J	3.6 J	1700 J	120 J	2.0 J	ND(0.01)	15 J	42 J	ND(0.02)	ND(0.01)
PCB-187	ug/Kg	0.42 J	4.5 J	1400 J	46 J	1.3 J	ND(0.01)	9.7 J	22 J	760 J	7.3 J
PCB-189	ug/Kg	ND(0.06)	ND(0.08)	ND(10)	3.7	ND(0.07)	ND(0.06)	ND(0.10)	ND(0.10)	23	ND(0.07)
PCB-195	ug/Kg	ND(0.01)	0.37 J	340 J	6.9 J	ND(0.01)	ND(0.01)	1.6 J	3.8 J	130 J	1.3 J
PCB-206	ug/Kg	ND(0.01)	ND(0.02)	160 J	4.0 J	ND(0.01)	ND(0.01)	1.1 J	3.0 J	44 J	ND(0.01)
PCB-209	ug/Kg	ND(0.01)	ND(0.02)	100	2.2	ND(0.01)	ND(0.01)	ND(0.02)	3.5	5.8	ND(0.01)
Total PCBs (18 congeners)	ug/Kg	1	42	19,842	750	16	ND(0.07)	144	675	6,217	74
Total PCBs (28 congeners)	ug/kg	1	42	26,702	886	17	ND(0.07)	162	685	6,940	77
POLYCHLORINATED BIPHENYLS (PCBs) - Aroclor Method											
Aroclor 1016	ug/kg	ND(12)	ND(15)	ND(200)	ND(13)	ND(13)	ND(12)	ND(20)	ND(19)	ND(190)	ND(13)
Aroclor 1221	ug/kg	ND(4.8)	ND(6.3)	ND(80)	ND(5.4)	ND(5.4)	ND(4.9)	ND(8.1)	ND(7.7)	ND(76)	ND(5.2)
Aroclor 1232	ug/kg	ND(4.8)	ND(6.3)	ND(80)	ND(5.4)	ND(5.4)	ND(4.9)	ND(8.1)	ND(7.7)	ND(76)	ND(5.2)
Aroclor 1242	ug/kg	ND(3.1)	ND(4.1)	ND(52)	ND(3.5)	ND(3.5)	ND(3.2)	ND(5.3)	ND(5.0)	ND(49)	ND(3.4)
Aroclor 1248	ug/kg	ND(1.7)	ND(2.2)	ND(28)	ND(1.9)	ND(1.9)	ND(1.7)	ND(2.8)	ND(2.7)	ND(27)	ND(1.8)
Aroclor 1254	ug/kg	ND(1.9)	1200 J	70000 J	2600 J	ND(2.2)	ND(1.9)	1100 J	4700 J	32000 J	ND(2.1)
Aroclor 1260	ug/kg	ND(4.3)	ND(5.6)	ND(72)	ND(4.8)	ND(4.8)	ND(4.4)	ND(7.3)	ND(6.9)	26000	ND(4.7)
Total PCBs (Aroclor method)	ug/kg	ND(4.8)	1200	70000	2600	ND(5.4)	ND(4.9)	1100	4700	58000	ND(5.2)
POLYCHLORINATED BIPHENYLS (PCBs) - Calculated Method											
Total PCBs (Calculated	ug/kg	3 E	100 E	64,000 E	2,100 E	37 E [41 E]	ND (0.01) E	390 E	2,400 E	17,000 E	180 E

Table C-3 Analytical Data (E&E, 2009).

Location ID: Depth Interval (ft): Sample Date:	Units:	YC-011 4 - 5 6/25/2009	YC-012 0 - 1 6/25/2009	YC-012 1 - 2 6/25/2009	YC-012 2 - 3 6/25/2009	YC-012 3 - 4 6/25/2009	YC-012 4 - 5 6/25/2009	YC-013 0 - 1 6/24/2009	YC-013 1 - 2 6/24/2009	YC-013 2 - 3 6/24/2009	YC-013 3 - 4 6/24/2009
PCB-118	ug/Kg	0.82	14	120	12	1.6	ND(0.01)	38	570	80	2
PCB-123	ug/Kg	ND(0.06)	ND(0.11)	ND(0.08)	ND(0.07)	ND(0.07)	ND(0.06)	ND(0.09)	ND(0.08)	ND(0.06)	ND(0.07)
PCB-126	ug/Kg	ND(0.06)	ND(0.11)	ND(0.08)	ND(0.07)	ND(0.07)	ND(0.06)	3.6	ND(0.08)	ND(0.06)	ND(0.07)
PCB-128	ug/Kg	ND(0.01)	24 J	36 J	3.0 J	ND(0.01)	ND(0.01)	7.3 J	120 J	10 J	0.70 J
PCB-138	ug/Kg	1.7 J	98 J	510 J	21 J	2.6 J	ND(0.01)	56 J	410 J	130 J	7.1 J
PCB-153	ug/Kg	2.1 J	81 J	560 J	24 J	3.4 J	ND(0.01)	45 J	550 J	540 J	10 J
PCB-156	ug/Kg	ND(0.06)	15 J	56 J	ND(0.07)	ND(0.07)	ND(0.06)	ND(0.09)	53 J	ND(0.06)	0.70 J
PCB-157	ug/Kg	ND(0.06)	ND(0.11)	ND(0.08)	ND(0.07)	ND(0.07)	ND(0.06)	ND(0.09)	ND(0.08)	ND(0.06)	ND(0.07)
PCB-167	ug/Kg	ND(0.06)	ND(0.11)	ND(0.08)	ND(0.07)	ND(0.07)	ND(0.06)	ND(0.09)	ND(0.08)	ND(0.06)	ND(0.07)
PCB-169	ug/Kg	ND(0.07)	ND(0.13)	ND(0.10)	ND(0.09)	ND(0.08)	ND(0.07)	ND(0.11)	ND(0.09)	ND(0.07)	ND(0.08)
PCB-170	ug/Kg	1.1 J	27 J	310 J	11 J	1.5 J	ND(0.01)	20 J	110 J	88 J	4.8 J
PCB-180	ug/Kg	1.7 J	45 J	510 J	21 J	2.7 J	ND(0.01)	34 J	160 J	130 J	9.0 J
PCB-187	ug/Kg	1.1 J	21 J	300 J	10 J	1.4 J	ND(0.01)	17 J	170 J	270 J	4.7 J
PCB-189	ug/Kg	ND(0.06)	ND(0.11)	ND(0.08)	ND(0.07)	ND(0.07)	ND(0.06)	ND(0.09)	ND(0.08)	ND(0.06)	ND(0.07)
PCB-195	ug/Kg	ND(0.01)	3.7 J	40 J	2.5 J	0.20 J	ND(0.01)	3.3 J	9.5 J	12 J	0.66 J
PCB-206	ug/Kg	ND(0.01)	3.1 J	16 J	1.2 J	ND(0.01)	ND(0.01)	2.8 J	7.5 J	10 J	ND(0.01)
PCB-209	ug/Kg	ND(0.01)	2.7	2.4 J	0.86	ND(0.01)	ND(0.01)	4.6	5.9	3.6	ND(0.01)
Total PCBs (18 congeners)	ug/Kg	10	616	2,984	151	16	ND(0.07)	399	3,965	1,941	45
Total PCBs (28 congeners)	ug/kg	10	631	3,040	151	16	ND(0.07)	402	4,018	1,941	46
POLYCHLORINATED BIPHENYLS (PCBs) - Aroclor Method											
Aroclor 1016	ug/kg	ND(12)	ND(100)	ND(160)	ND(15)	ND(13)	ND(12)	ND(18)	ND(76)	ND(12)	ND(13)
Aroclor 1221	ug/kg	ND(5.0)	ND(43)	ND(64)	ND(6.0)	ND(5.2)	ND(5.0)	ND(7.2)	ND(31)	ND(4.9)	ND(5.2)
Aroclor 1232	ug/kg	ND(5.0)	ND(43)	ND(64)	ND(6.0)	ND(5.2)	ND(5.0)	ND(7.2)	ND(31)	ND(4.9)	ND(5.2)
Aroclor 1242	ug/kg	ND(3.3)	ND(28)	ND(41)	ND(3.9)	ND(3.4)	ND(3.2)	ND(4.7)	ND(20)	ND(3.2)	ND(3.4)
Aroclor 1248	ug/kg	ND(1.8)	ND(15)	ND(22)	ND(2.1)	ND(1.8)	ND(1.7)	ND(2.5)	ND(11)	ND(1.7)	ND(1.8)
Aroclor 1254	ug/kg	ND(2.0)	8700 J	13000 J	910 J	ND(2.1)	ND(2.0)	3100 J	30000 J	2700 J	ND(2.1)
Aroclor 1260	ug/kg	ND(4.5)	ND(38)	ND(57)	ND(5.4)	ND(4.7)	ND(4.5)	2300	ND(28)	ND(4.4)	ND(4.7)
Total PCBs (Aroclor method)	ug/kg	ND(5.0)	8700	13000	910	ND(5.2)	ND(5.0)	5400	30000	2700	ND(5.2)
POLYCHLORINATED BIPHENYLS (PCBs) - Calculated Method											
Total PCBs (Calculated	ug/kg	24 E	1,500 E	7,200 E	360 E	37 E	ND (0.01) E	960 E	9,600 E	4,600 E	140 E [110

Table C-3 Analytical Data (E&E, 2009).

Location ID:		YC-013	YC-014	YC-014	YC-014	YC-014	YC-014	YC-015	YC-015	YC-015	YC-015
Depth Interval (ft):		4 - 5	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	0 - 1	1 - 2	2 - 3	3 - 4
Sample Date:	Units:	6/24/2009	6/25/2009	6/25/2009	6/25/2009	6/25/2009	6/25/2009	7/7/2009	7/7/2009	7/7/2009	7/7/2009
PCB-118	ug/Kg	ND(0.01)	7.7	96	12	1.6	ND(0.01)	290 J	4000 J	200 J	5.3 J
PCB-123	ug/Kg	ND(0.07)	ND(0.10)	ND(0.09)	ND(0.07)	ND(0.07)	ND(0.07)	ND(0.09)	ND(4.4)	ND(0.07)	ND(0.06)
PCB-126	ug/Kg	ND(0.07)	ND(0.10)	ND(0.09)	ND(0.07)	ND(0.07)	ND(0.07)	ND(0.09)	ND(4.4)	ND(0.07)	ND(0.06)
PCB-128	ug/Kg	1.0 J	2.1 J	19 J	3.2 J	ND(0.01)	ND(0.01)	55 J	1000 J	60 J	1.4 J
PCB-138	ug/Kg	1.5 J	12 J	270 J	36 J	3.1 J	ND(0.01)	490 J	3600 J	210 J	4.7 J
PCB-153	ug/Kg	1.8 J	16 J	600 J	46 J	7.9 J	ND(0.01)	440 J	3600 J	330 J	5.0 J
PCB-156	ug/Kg	1.1 J	1.4 J	19 J	ND(0.07)	ND(0.07)	ND(0.07)	ND(0.09)	ND(4.4)	ND(0.07)	ND(0.06)
PCB-157	ug/Kg	ND(0.07)	ND(0.10)	ND(0.09)	ND(0.07)	ND(0.07)	ND(0.07)	270 J	1200 J	85 J	ND(0.06)
PCB-167	ug/Kg	ND(0.07)	ND(0.10)	ND(0.09)	ND(0.07)	ND(0.07)	ND(0.07)	ND(0.09)	ND(4.4)	ND(0.07)	ND(0.06)
PCB-169	ug/Kg	ND(0.08)	ND(0.13)	ND(0.11)	ND(0.09)	ND(0.08)	ND(0.08)	ND(0.10)	ND(5.3)	ND(0.08)	ND(0.08)
PCB-170	ug/Kg	1.3 J	7.6 J	150 J	16 J	2.8 J	ND(0.01)	170 J	830 J	70 J	1.1 J
PCB-180	ug/Kg	1.1 J	12 J	260 J	30 J	4.7 J	ND(0.01)	270 J	1200 J	86 J	1.6 J
PCB-187	ug/Kg	1.6 J	8.2 J	300 J	18 J	3.6 J	ND(0.01)	150 J	760 J	110 J	1.1 J
PCB-189	ug/Kg	ND(0.07)	ND(0.10)	ND(0.09)	ND(0.07)	ND(0.07)	ND(0.07)	ND(0.09)	ND(4.4)	ND(0.07)	ND(0.06)
PCB-195	ug/Kg	1.0 J	1.1 J	24 J	2.4 J	0.43 J	ND(0.01)	24 J	100 J	ND(0.01)	ND(0.01)
PCB-206	ug/Kg	1.8 J	1.1 J	14 J	1.5 J	ND(0.01)	ND(0.01)	19 J	78 J	ND(0.01)	ND(0.01)
PCB-209	ug/Kg	3.2	ND(0.02)	2.8	ND(0.01)	ND(0.01)	ND(0.01)	14 J	ND(0.88)	ND(0.01)	ND(0.01)
Total PCBs (18 congeners)	ug/Kg	18	89	2,400	223	32	ND(0.08)	3,725	33,168	2,242	44
Total PCBs (28 congeners)	ug/kg	19	91	2,419	223	32	ND(0.08)	3,995	34,368	2,327	45
POLYCHLORINATED BIPHENYLS (PCBs) - Aroclor Method											
Aroclor 1016	ug/kg	ND(14)	ND(20)	ND(180)	ND(14)	ND(13)	ND(14)	ND(17)	ND(340)	ND(13)	ND(13)
Aroclor 1221	ug/kg	ND(5.6)	ND(8.3)	ND(72)	ND(5.9)	ND(5.3)	ND(5.5)	ND(7.0)	ND(140)	ND(5.3)	ND(5.1)
Aroclor 1232	ug/kg	ND(5.6)	ND(8.3)	ND(72)	ND(5.9)	ND(5.3)	ND(5.5)	ND(7.0)	ND(140)	ND(5.3)	ND(5.1)
Aroclor 1242	ug/kg	ND(3.7)	ND(5.4)	ND(47)	ND(3.8)	ND(3.4)	ND(3.6)	ND(4.5)	ND(91)	ND(3.4)	ND(3.3)
Aroclor 1248	ug/kg	ND(2.0)	ND(2.9)	ND(25)	ND(2.1)	ND(1.8)	ND(1.9)	ND(2.4)	ND(49)	ND(1.9)	ND(1.8)
Aroclor 1254	ug/kg	ND(2.3)	750 J	27000 J	1200 J	ND(2.1)	ND(2.2)	8500 J	130000 J	12000 J	300 J
Aroclor 1260	ug/kg	ND(5.1)	ND(7.5)	ND(65)	ND(5.3)	ND(4.7)	ND(5.0)	ND(6.3)	ND(130)	ND(4.8)	ND(4.6)
Total PCBs (Aroclor method)	ug/kg	ND(5.6)	750	27000	1200	ND(5.3)	ND(5.5)	8500	130000	12000	300
POLYCHLORINATED BIPHENYLS (PCBs) - Calculated Method											
Total PCBs (Calculated	ug/kg	46 E	220 E	5,800 E	530 E	68 E [76 E]	ND (0.01) E	9,500 E	82,000 E	5,500 E	110 E

Table C-3 Analytical Data (E&E, 2009).

Location ID:		YC-015	YC-016	YC-016	YC-016	YC-017	YC-017	YC-017	YC-017	YC-017	YC-018
Depth Interval (ft):		4 - 5	0 - 1	1 - 2	2 - 3	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	0 - 1
Sample Date:	Units:	7/7/2009	7/1/2009	7/1/2009	7/1/2009	6/23/2009	6/23/2009	6/23/2009	6/23/2009	6/23/2009	6/23/2009
PCB-118	ug/Kg	3.5 J	31 J	240 J	6.6	8.5 J	20 J	9.4 J	0.96 J	ND(0.01)	20 J
PCB-123	ug/Kg	ND(0.09)	ND(0.08)	ND(0.08)	ND(0.07)	ND(0.10)	ND(0.09)	ND(0.08)	ND(0.07)	ND(0.07)	ND(0.09)
PCB-126	ug/Kg	ND(0.09)	ND(0.08)	ND(0.08)	ND(0.07)	ND(0.10)	ND(0.09)	ND(0.08)	ND(0.07)	ND(0.07)	ND(0.09)
PCB-128	ug/Kg	ND(0.02)	44	65 J	1.4 J	2.8 J	4.9 J	6.8 J	ND(0.01)	ND(0.01)	3.5 J
PCB-138	ug/Kg	3.0 J	130 J	340 J	18 J	16 J	25 J	47 J	4.0 J	ND(0.01)	17 J
PCB-153	ug/Kg	3.5 J	170 J	420 J	17 J	21 J	40 J	56 J	5.6 J	ND(0.01)	23 J
PCB-156	ug/Kg	ND(0.09)	13	ND(0.08)	13	2	3.3	55	ND(0.07)	ND(0.07)	2
PCB-157	ug/Kg	ND(0.09)	ND(0.08)	ND(0.08)	ND(0.07)	ND(0.10)	ND(0.09)	ND(0.08)	ND(0.07)	ND(0.07)	ND(0.09)
PCB-167	ug/Kg	ND(0.09)	8.6	ND(0.08)	ND(0.07)	ND(0.10)	ND(0.09)	ND(0.08)	ND(0.07)	ND(0.07)	ND(0.09)
PCB-169	ug/Kg	ND(0.10)	17 J	33 J	1.8 J	ND(0.12)	ND(0.11)	ND(0.10)	ND(0.09)	ND(0.08)	ND(0.10)
PCB-170	ug/Kg	ND(0.02)	51	180	7.6	9.8 J	14 J	32 J	2.8 J	ND(0.01)	13 J
PCB-180	ug/Kg	1.2 J	150	270	14	16 J	23 J	59 J	5.0 J	ND(0.01)	19 J
PCB-187	ug/Kg	ND(0.02)	47	170	7.7	10 J	18 J	25 J	2.5 J	ND(0.01)	11 J
PCB-189	ug/Kg	ND(0.09)	2.8	4.2	ND(0.07)	ND(0.10)	ND(0.09)	ND(0.08)	ND(0.07)	ND(0.07)	ND(0.09)
PCB-195	ug/Kg	ND(0.02)	7.1	16	0.93	1.6 J	2.3 J	7.4 J	0.34 J	ND(0.01)	2.3 J
PCB-206	ug/Kg	ND(0.02)	3.8	8.4	1.4	1.2 J	1.8 J	2.8 J	ND(0.01)	ND(0.01)	4.4 J
PCB-209	ug/Kg	ND(0.02)	ND(0.02)	3.6	ND(0.01)	ND(0.02)	ND(0.02)	1.5	ND(0.01)	ND(0.01)	1.9
Total PCBs (18 congeners)	ug/Kg	25	873	2,473	106	141	275	346	24	ND(0.08)	227
Total PCBs (28 congeners)	ug/kg	25	974	2,620	121	143	279	401	24	ND(0.08)	229
POLYCHLORINATED BIPHENYLS (PCBs) - Aroclor Method											
Aroclor 1016	ug/kg	ND(17)	ND(15)	ND(16)	ND(14)	ND(20)	ND(18)	ND(16)	ND(15)	ND(13)	ND(17)
Aroclor 1221	ug/kg	ND(6.9)	ND(6.3)	ND(6.4)	ND(5.6)	ND(8.1)	ND(7.3)	ND(6.7)	ND(6.0)	ND(5.3)	ND(6.8)
Aroclor 1232	ug/kg	ND(6.9)	ND(6.3)	ND(6.4)	ND(5.6)	ND(8.1)	ND(7.3)	ND(6.7)	ND(6.0)	ND(5.3)	ND(6.8)
Aroclor 1242	ug/kg	ND(4.5)	ND(4.1)	ND(4.1)	ND(3.7)	ND(5.3)	ND(4.7)	ND(4.3)	ND(3.9)	ND(3.4)	ND(4.5)
Aroclor 1248	ug/kg	ND(2.4)	ND(2.2)	ND(2.2)	ND(2.0)	ND(2.8)	ND(2.6)	ND(2.3)	ND(2.1)	ND(1.9)	ND(2.4)
Aroclor 1254	ug/kg	ND(2.8)	1900 J	9000 J	500 J	2300 J	1500 J	1500 J	ND(2.4)	ND(2.1)	850 J
Aroclor 1260	ug/kg	ND(6.3)	ND(5.6)	ND(5.7)	ND(5.1)	ND(7.3)	ND(6.6)	ND(6.0)	ND(5.4)	ND(4.8)	ND(6.2)
Total PCBs (Aroclor method)	ug/kg	ND(6.9)	1900	9000	500	2300	1500	1500	ND(6.0)	ND(5.3)	850
POLYCHLORINATED BIPHENYLS (PCBs) - Calculated Method											
Total PCBs (Calculated	ug/kg	60 E	2,300 E	6,200 E	290 E	530 E [240	660 E	950 E	57 E	ND (0.01) E	540 E

Table C-3 Analytical Data (E&E, 2009).

Location ID:		YC-018	YC-018	YC-018	YC-018	YC-019	YC-019	YC-019	YC-019	YC-019	YC-020
Depth Interval (ft):		1 - 2	2 - 3	3 - 4	4 - 5	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	0 - 1
Sample Date:	Units:	6/23/2009	6/23/2009	6/23/2009	6/23/2009	6/22/2009	6/22/2009	6/22/2009	6/22/2009	6/22/2009	6/22/2009
PCB-118	ug/Kg	730 J	280 J	35 J	ND(0.01)	15 J	83 J	12 J	1.9 J	0.36 J	4.0 J
PCB-123	ug/Kg	ND(0.09)	ND(0.09)	ND(0.09)	ND(0.08)	ND(0.09)	ND(0.09)	ND(0.08)	ND(0.08)	ND(0.08)	ND(0.10)
PCB-126	ug/Kg	ND(0.09)	ND(0.09)	ND(0.09)	ND(0.08)	ND(0.09)	ND(0.09)	ND(0.08)	ND(0.08)	ND(0.08)	ND(0.10)
PCB-128	ug/Kg	150 J	55 J	18 J	ND(0.01)	4.5 J	16 J	3.1 J	ND(0.02)	ND(0.02)	1.3 J
PCB-138	ug/Kg	600 J	430 J	160 J	100 J	23 J	110 J	27 J	3.5 J	ND(0.02)	7.7 J
PCB-153	ug/Kg	510 J	590 J	220 J	18 J	24 J	230 J	37 J	8.8 J	ND(0.02)	9.9 J
PCB-156	ug/Kg	69	41	ND(0.09)	ND(0.08)	3.0 J	14	ND(0.08)	ND(0.08)	ND(0.08)	0.78 J
PCB-157	ug/Kg	ND(0.09)	ND(0.09)	ND(0.09)	ND(0.08)	ND(0.09)	ND(0.09)	ND(0.08)	ND(0.08)	ND(0.08)	ND(0.10)
PCB-167	ug/Kg	ND(0.09)	ND(0.09)	ND(0.09)	ND(0.08)	ND(0.09)	ND(0.09)	ND(0.08)	ND(0.08)	ND(0.08)	ND(0.10)
PCB-169	ug/Kg	ND(0.11)	ND(0.11)	ND(0.10)	ND(0.09)	ND(0.11)	ND(0.11)	ND(0.10)	ND(0.10)	ND(0.09)	ND(0.12)
PCB-170	ug/Kg	130 J	280 J	130 J	7.5 J	13 J	41 J	11 J	1.6 J	ND(0.02)	4.5 J
PCB-180	ug/Kg	190 J	480 J	220 J	13 J	19 J	110 J	ND(0.02)	ND(0.02)	ND(0.02)	ND(0.02)
PCB-187	ug/Kg	730 J	290 J	120 J	ND(0.01)	9.8 J	66 J	15 J	2.9 J	ND(0.02)	3.6 J
PCB-189	ug/Kg	ND(0.09)	ND(0.09)	ND(0.09)	ND(0.08)	ND(0.09)	ND(0.09)	ND(0.08)	ND(0.08)	ND(0.08)	ND(0.10)
PCB-195	ug/Kg	8.5 J	33 J	16 J	2.4 J	2.0 J	8.2 J	2.7 J	0.31 J	ND(0.02)	ND(0.02)
PCB-206	ug/Kg	8.9 J	18 J	7.8 J	2.0 J	2.0 J	5.3	1.2 J	ND(0.02)	ND(0.02)	ND(0.02)
PCB-209	ug/Kg	5.5	5.5	3	2.4	ND(0.02)	ND(0.02)	ND(0.02)	ND(0.02)	ND(0.02)	ND(0.02)
Total PCBs (18 congeners)	ug/Kg	5,568	3,815	1,218	194	174	1,169	185	29	ND(0.09)	42
Total PCBs (28 congeners)	ug/kg	5,637	3,856	1,218	194	177	1,183	185	29	ND(0.09)	43
POLYCHLORINATED BIPHENYLS (PCBs) - Aroclor Method											
Aroclor 1016	ug/kg	ND(17)	ND(18)	ND(17)	ND(15)	ND(18)	ND(17)	ND(16)	ND(16)	ND(15)	ND(20)
Aroclor 1221	ug/kg	ND(7.1)	ND(7.4)	ND(7.0)	ND(6.2)	ND(7.4)	ND(7.1)	ND(6.7)	ND(6.4)	ND(6.2)	ND(8.0)
Aroclor 1232	ug/kg	ND(7.1)	ND(7.4)	ND(7.0)	ND(6.2)	ND(7.4)	ND(7.1)	ND(6.7)	ND(6.4)	ND(6.2)	ND(8.0)
Aroclor 1242	ug/kg	ND(4.6)	ND(4.8)	ND(4.5)	ND(4.0)	ND(4.8)	ND(4.6)	ND(4.4)	ND(4.2)	ND(4.0)	ND(5.2)
Aroclor 1248	ug/kg	ND(2.5)	ND(2.6)	ND(2.4)	ND(2.2)	ND(2.6)	ND(2.5)	ND(2.3)	ND(2.3)	ND(2.2)	ND(2.8)
Aroclor 1254	ug/kg	27000 J	12000 J	5400 J	880 J	1200 J	5300 J	1900 J	610 J	ND(2.5)	580 J
Aroclor 1260	ug/kg	ND(6.4)	7600 J	4500 J	ND(5.6)	ND(6.7)	ND(6.4)	ND(6.0)	ND(5.8)	ND(5.6)	ND(7.2)
Total PCBs (Aroclor method)	ug/kg	27000	19600	9900	880	1200	5300	1900	610	ND(6.2)	580
POLYCHLORINATED BIPHENYLS (PCBs) - Calculated Method											
Total PCBs (Calculated	ug/kg	13,000 E	9,200 E	3,300 E	460 E	420 E	2,800 E	440 E	70 E	1 E	100 E [160

Table C-3 Analytical Data (E&E, 2009).

Location ID:		YC-020	YC-020	YC-020	YC-020	YC-021	YC-021	YC-021	YC-021	YC-021	YC-022
Depth Interval (ft):		1 - 2	2 - 3	3 - 4	4 - 5	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	0 - 1
Sample Date:	Units:	6/22/2009	6/22/2009	6/22/2009	6/22/2009	6/22/2009	6/22/2009	6/22/2009	6/22/2009	6/22/2009	6/22/2009
PCB-118	ug/Kg	15 J	50 J	ND(0.02)	ND(0.01)	4.7 J	51 J	77 J	39 J	20 J	3.3 J
PCB-123	ug/Kg	ND(0.07)	ND(0.09)	ND(0.09)	ND(0.07)	ND(0.08)	ND(0.07)	ND(0.10)	ND(0.09)	ND(0.10)	ND(0.08)
PCB-126	ug/Kg	ND(0.07)	ND(0.09)	ND(0.09)	ND(0.07)	ND(0.08)	ND(0.07)	ND(0.10)	ND(0.09)	ND(0.10)	ND(0.08)
PCB-128	ug/Kg	4.0 J	9.1 J	4.1 J	1.4 J	1.4 J	11 J	17 J	42 J	5.2 J	1.0 J
PCB-138	ug/Kg	22 J	57 J	ND(0.02)	12 J	8.3 J	67 J	140 J	140 J	22 J	6.1 J
PCB-153	ug/Kg	28 J	73 J	ND(0.02)	5.9 J	13 J	73 J	200 J	180 J	21 J	7.3 J
PCB-156	ug/Kg	2.5	47	ND(0.09)	ND(0.07)	0.93	8.4	14	ND(0.09)	ND(0.10)	0.55 J
PCB-157	ug/Kg	ND(0.07)	ND(0.09)	ND(0.09)	ND(0.07)	ND(0.08)	ND(0.07)	ND(0.10)	ND(0.09)	ND(0.10)	ND(0.08)
PCB-167	ug/Kg	ND(0.07)	ND(0.09)	ND(0.09)	ND(0.07)	ND(0.08)	ND(0.07)	ND(0.10)	ND(0.09)	ND(0.10)	ND(0.08)
PCB-169	ug/Kg	ND(0.09)	ND(0.11)	ND(0.10)	ND(0.08)	ND(0.09)	ND(0.09)	ND(0.12)	ND(0.11)	ND(0.12)	ND(0.09)
PCB-170	ug/Kg	11 J	31 J	12 J	2.7 J	3.4 J	20 J	70 J	70 J	9.0 J	3.1 J
PCB-180	ug/Kg	18 J	ND(0.02)	19 J	6.3 J	6.5 J	39 J	120 J	180 J	16 J	4.8 J
PCB-187	ug/Kg	9.9 J	26 J	ND(0.02)	12 J	4.0 J	28 J	67 J	54 J	8.3 J	3.4 J
PCB-189	ug/Kg	ND(0.07)	ND(0.09)	ND(0.09)	ND(0.07)	ND(0.08)	ND(0.07)	ND(0.10)	ND(0.09)	ND(0.10)	ND(0.08)
PCB-195	ug/Kg	1.5 J	4.2 J	2.8 J	ND(0.01)	0.64 J	4.1 J	10 J	9.6 J	2.8 J	0.41 J
PCB-206	ug/Kg	0.96 J	2.6 J	ND(0.02)	0.46 J	0.48 J	2.6 J	5.5 J	4.7 J	1.6 J	ND(0.02)
PCB-209	ug/Kg	ND(0.01)	ND(0.02)	ND(0.02)	ND(0.01)	ND(0.02)	ND(0.01)	ND(0.02)	ND(0.02)	ND(0.02)	ND(0.02)
Total PCBs (18 congeners)	ug/Kg	176	605	72	59	61	494	1,054	858	167	41
Total PCBs (28 congeners)	ug/kg	178	652	72	59	61	502	1,068	858	167	42
POLYCHLORINATED BIPHENYLS (PCBs) - Aroclor Method											
Aroclor 1016	ug/kg	ND(14)	ND(18)	ND(17)	ND(13)	ND(15)	ND(14)	ND(19)	ND(18)	ND(19)	ND(15)
Aroclor 1221	ug/kg	ND(5.9)	ND(7.4)	ND(7.0)	ND(5.4)	ND(6.2)	ND(5.8)	ND(7.7)	ND(7.4)	ND(7.9)	ND(6.3)
Aroclor 1232	ug/kg	ND(5.9)	ND(7.4)	ND(7.0)	ND(5.4)	ND(6.2)	ND(5.8)	ND(7.7)	ND(7.4)	ND(7.9)	ND(6.3)
Aroclor 1242	ug/kg	ND(3.8)	ND(4.8)	ND(4.5)	ND(3.5)	ND(4.0)	ND(3.8)	ND(5.0)	ND(4.8)	ND(5.2)	ND(4.1)
Aroclor 1248	ug/kg	ND(2.1)	ND(2.6)	ND(2.4)	ND(1.9)	ND(2.2)	ND(2.0)	ND(2.7)	ND(2.6)	ND(2.8)	ND(2.2)
Aroclor 1254	ug/kg	1800 J	3400 J	1500 J	920 J	750 J	3700 J	5300 J	2300 J	930 J	300 J
Aroclor 1260	ug/kg	ND(5.3)	ND(6.6)	ND(6.3)	ND(4.9)	ND(5.6)	ND(5.2)	3700 J	1800 J	ND(7.1)	ND(5.6)
Total PCBs (Aroclor method)	ug/kg	1800	3400	1500	920	750	3700	9000	4100	930	300
POLYCHLORINATED BIPHENYLS (PCBs) - Calculated Method											
Total PCBs (Calculated	ug/kg	420 E	1,500 E	170 E	140 E	150 E	1,200 E	2,500 E	2,000 E	400 E	100 E

Table C-3 Analytical Data (E&E, 2009).

Location ID:		YC-022	YC-022	YC-022	YC-022	YC-023	YC-023	YC-023	YC-023	YC-023	YC-024
Depth Interval (ft):		1 - 2	2 - 3	3 - 4	4 - 5	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	0 - 1
Sample Date:	Units:	6/22/2009	6/22/2009	6/22/2009	6/22/2009	6/18/2009	6/18/2009	6/18/2009	6/18/2009	6/18/2009	6/22/2009
PCB-118	ug/Kg	6.2 J	7.0 J	34 J	32 J	9.7	91	9.8	ND(0.01)	ND(0.02)	13 J
PCB-123	ug/Kg	ND(0.07)	ND(0.09)	ND(0.08)	ND(0.08)	ND(0.07)	ND(0.11)	ND(0.10)	ND(0.07)	ND(0.09)	ND(0.09)
PCB-126	ug/Kg	ND(0.07)	ND(0.09)	ND(0.08)	ND(0.08)	ND(0.07)	ND(0.11)	ND(0.10)	ND(0.07)	ND(0.09)	ND(0.09)
PCB-128	ug/Kg	1.5 J	2.1 J	9.5 J	8.6 J	2.8	26	2.8	ND(0.01)	ND(0.02)	7.7 J
PCB-138	ug/Kg	7.5 J	13 J	91 J	54 J	23 J	98 J	13 J	0.26 J	ND(0.02)	65 J
PCB-153	ug/Kg	11 J	17 J	110 J	100 J	57	150	14	0.39 J	ND(0.02)	99 J
PCB-156	ug/Kg	0.9	ND(0.09)	10	8.1	3	20	10	ND(0.07)	ND(0.09)	ND(0.09)
PCB-157	ug/Kg	ND(0.07)	ND(0.09)	ND(0.08)	ND(0.08)	ND(0.07)	ND(0.11)	11	ND(0.07)	ND(0.09)	ND(0.09)
PCB-167	ug/Kg	ND(0.07)	ND(0.09)	ND(0.08)	ND(0.08)	1.4	8.5	ND(0.10)	ND(0.07)	ND(0.09)	ND(0.09)
PCB-169	ug/Kg	ND(0.08)	ND(0.11)	ND(0.10)	12	ND(0.09)	ND(0.13)	ND(0.12)	ND(0.09)	ND(0.10)	ND(0.10)
PCB-170	ug/Kg	4.0 J	8.1 J	45 J	35 J	13 J	66 J	5.5 J	ND(0.01)	ND(0.02)	37 J
PCB-180	ug/Kg	ND(0.01)	ND(0.02)	ND(0.02)	ND(0.01)	23 J	110 J	11 J	ND(0.01)	ND(0.02)	62 J
PCB-187	ug/Kg	4.0 J	6.1 J	34 J	21 J	22 J	79 J	4.4 J	ND(0.01)	ND(0.02)	33 J
PCB-189	ug/Kg	ND(0.07)	ND(0.09)	ND(0.08)	ND(0.08)	ND(0.07)	4.4	ND(0.10)	ND(0.07)	ND(0.09)	ND(0.09)
PCB-195	ug/Kg	0.52 J	1.4 J	7.4 J	6.1 J	2.7	15	1.1 J	ND(0.01)	ND(0.02)	6.1 J
PCB-206	ug/Kg	0.83 J	ND(0.02)	3.2 J	2.6 J	1.9 J	7.9 J	ND(0.02)	ND(0.01)	ND(0.02)	2.8 J
PCB-209	ug/Kg	ND(0.01)	ND(0.02)	1.8	1.1	ND(0.01)	3	ND(0.02)	ND(0.01)	ND(0.02)	ND(0.02)
Total PCBs (18 congeners)	ug/Kg	65	84	493	398	196	1,064	99	1	ND(0.10)	463
Total PCBs (28 congeners)	ug/kg	66	84	503	419	200	1,097	130	1	ND(0.10)	463
POLYCHLORINATED BIPHENYLS (PCBs) - Aroclor Method											
Aroclor 1016	ug/kg	ND(13)	ND(18)	ND(16)	ND(15)	ND(14)	ND(21)	ND(19)	ND(15)	ND(17)	ND(17)
Aroclor 1221	ug/kg	ND(5.4)	ND(7.4)	ND(6.4)	ND(6.1)	ND(5.6)	ND(8.5)	ND(7.9)	ND(6.0)	ND(6.8)	ND(6.9)
Aroclor 1232	ug/kg	ND(5.4)	ND(7.4)	ND(6.4)	ND(6.1)	ND(5.6)	ND(8.5)	ND(7.9)	ND(6.0)	ND(6.8)	ND(6.9)
Aroclor 1242	ug/kg	ND(3.5)	ND(4.8)	ND(4.2)	ND(4.0)	ND(3.7)	ND(5.5)	ND(5.1)	ND(3.9)	ND(4.4)	ND(4.5)
Aroclor 1248	ug/kg	ND(1.9)	ND(2.6)	ND(2.3)	ND(2.1)	ND(2.0)	ND(3.0)	ND(2.8)	ND(2.1)	ND(2.4)	ND(2.4)
Aroclor 1254	ug/kg	890 J	650 J	2400 J	2400 J	1500 J	9000 J	380 J	ND(2.4)	ND(2.7)	1400 J
Aroclor 1260	ug/kg	ND(4.8)	ND(6.6)	ND(5.8)	ND(5.5)	ND(5.0)	ND(7.6)	ND(7.1)	ND(5.4)	ND(6.1)	ND(6.2)
Total PCBs (Aroclor method)	ug/kg	890	650	2400	2400	1500	9000	380	ND(6.0)	ND(6.8)	1400
POLYCHLORINATED BIPHENYLS (PCBs) - Calculated Method											
Total PCBs (Calculated	ug/kg	160 E	200 E	1,300 E	1,000 E	480 E	2,600 E	310 E	2 E	ND (0.01) E	1,100 E

Table C-3 Analytical Data (E&E, 2009).

Location ID:		YC-024	YC-024	YC-024	YC-024	YC-025	YC-025	YC-025	YC-025	YC-025	YC-026
Depth Interval (ft):		1 - 2	2 - 3	3 - 4	4 - 5	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	0 - 1
Sample Date:	Units:	6/22/2009	6/22/2009	6/22/2009	6/22/2009	6/18/2009	6/18/2009	6/18/2009	6/18/2009	6/18/2009	6/18/2009
PCB-118	ug/Kg	16 J	20 J	ND(0.02)	ND(0.02)	25	72	45	3.9	0.67 J	86
PCB-123	ug/Kg	ND(0.08)	ND(0.10)	ND(0.10)	ND(0.09)	ND(0.08)	ND(0.08)	ND(0.10)	ND(0.10)	ND(0.09)	ND(0.08)
PCB-126	ug/Kg	ND(0.08)	ND(0.10)	ND(0.10)	ND(0.09)	ND(0.08)	ND(0.08)	ND(0.10)	ND(0.10)	ND(0.09)	ND(0.08)
PCB-128	ug/Kg	9.0 J	4.7 J	0.83 J	ND(0.02)	7.1	15	12	1.1	ND(0.02)	17
PCB-138	ug/Kg	57 J	29 J	4.0 J	1.9 J	46 J	97 J	72 J	4.7 J	2.7 J	91 J
PCB-153	ug/Kg	110 J	29 J	4.7 J	ND(0.02)	110	230	69	6.6	1.3	110
PCB-156	ug/Kg	7.1	ND(0.10)	ND(0.10)	ND(0.09)	ND(0.08)	14	ND(0.10)	4.8	ND(0.09)	12
PCB-157	ug/Kg	ND(0.08)	ND(0.10)	ND(0.10)	ND(0.09)	ND(0.08)	ND(0.08)	ND(0.10)	ND(0.10)	ND(0.09)	ND(0.08)
PCB-167	ug/Kg	ND(0.08)	ND(0.10)	ND(0.10)	ND(0.09)	2.3	4.7	2.8	ND(0.10)	ND(0.09)	37
PCB-169	ug/Kg	ND(0.09)	ND(0.12)	ND(0.12)	ND(0.11)	ND(0.09)	ND(0.10)	ND(0.12)	ND(0.11)	ND(0.11)	ND(0.10)
PCB-170	ug/Kg	40 J	12 J	1.6 J	0.97 J	31 J	48 J	30 J	2.8 J	0.43 J	42 J
PCB-180	ug/Kg	61 J	18 J	3.1 J	1.6 J	52 J	77 J	49 J	5.0 J	0.73 J	72 J
PCB-187	ug/Kg	31 J	9.7 J	ND(0.02)	0.64 J	34 J	110 J	23 J	2.8 J	ND(0.02)	39 J
PCB-189	ug/Kg	ND(0.08)	ND(0.10)	ND(0.10)	ND(0.09)	ND(0.08)	2.5	ND(0.10)	ND(0.10)	ND(0.09)	ND(0.08)
PCB-195	ug/Kg	5.7 J	2.2 J	ND(0.02)	ND(0.02)	5.1	8.3	4.9	0.57 J	ND(0.02)	5.6
PCB-206	ug/Kg	3.5 J	1.5 J	ND(0.02)	ND(0.02)	3.5 J	6.5 J	3.0 J	ND(0.02)	ND(0.02)	4.7 J
PCB-209	ug/Kg	ND(0.02)	ND(0.02)	ND(0.02)	ND(0.02)	1.5	4.9	2.1	ND(0.02)	ND(0.02)	2.9
Total PCBs (18 congeners)	ug/Kg	484	197	26	7	513	1,154	523	43	8	810
Total PCBs (28 congeners)	ug/kg	491	197	26	7	515	1,175	526	48	8	859
POLYCHLORINATED BIPHENYLS (PCBs) - Aroclor Method											
Aroclor 1016	ug/kg	ND(15)	ND(19)	ND(20)	ND(18)	170 J	ND(16)	ND(19)	ND(19)	ND(18)	ND(16)
Aroclor 1221	ug/kg	ND(6.3)	ND(8.0)	ND(8.3)	ND(7.3)	ND(6.1)	ND(6.6)	ND(7.7)	ND(7.6)	ND(7.2)	ND(6.7)
Aroclor 1232	ug/kg	ND(6.3)	ND(8.0)	ND(8.3)	ND(7.3)	ND(6.1)	ND(6.6)	ND(7.7)	ND(7.6)	ND(7.2)	ND(6.7)
Aroclor 1242	ug/kg	ND(4.1)	ND(5.2)	ND(5.4)	ND(4.7)	ND(4.0)	ND(4.3)	ND(5.0)	ND(5.0)	ND(4.7)	ND(4.3)
Aroclor 1248	ug/kg	ND(2.2)	ND(2.8)	ND(2.9)	ND(2.5)	ND(2.1)	ND(2.3)	ND(2.7)	ND(2.7)	ND(2.5)	ND(2.3)
Aroclor 1254	ug/kg	4500 J	3000 J	470 J	180 J	1000 J	3300 J	2900 J	170 J	94 J	3900 J
Aroclor 1260	ug/kg	ND(5.7)	ND(7.2)	ND(7.5)	ND(6.5)	770	ND(6.0)	ND(6.9)	ND(6.9)	ND(6.5)	ND(6.0)
Total PCBs (Aroclor method)	ug/kg	4500	3000	470	180	1940	3300	2900	170	94	3900
POLYCHLORINATED BIPHENYLS (PCBs) - Calculated Method											
Total PCBs (Calculated	ug/kg	1,200 E	470 E	61 E	17 E	1,200 E	2,800 E	1,300 E	110 E	19 E	2,000 E

Table C-3 Analytical Data (E&E, 2009).

Location ID:		YC-026	YC-026	YC-026	YC-026	YC-029	YC-029	YC-029	YC-029	YC-029	YC-030
Depth Interval (ft):		1 - 2	2 - 3	3 - 4	4 - 5	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	0 - 1
Sample Date:	Units:	6/18/2009	6/18/2009	6/18/2009	6/18/2009	7/6/2009	7/6/2009	7/6/2009	7/6/2009	7/6/2009	7/6/2009
PCB-118	ug/Kg	55	4.2	4.8	0.67 J	16 J	93 J	480 J	240 J	13 J	22 J
PCB-123	ug/Kg	ND(0.10)	ND(0.11)	ND(0.11)	0.91 J	ND(0.10)	ND(0.10)	ND(1.1)	ND(1.1)	ND(0.08)	44
PCB-126	ug/Kg	ND(0.10)	ND(0.11)	ND(0.11)	ND(0.09)	ND(0.10)	ND(0.10)	ND(1.1)	ND(1.1)	ND(0.08)	22
PCB-128	ug/Kg	12	0.81 J	1.1	ND(0.02)	ND(0.02)	ND(0.02)	240 J	180 J	7.9 J	26 J
PCB-138	ug/Kg	75 J	4.1 J	5.9 J	0.92 J	48 J	290 J	650 J	400 J	21 J	60 J
PCB-153	ug/Kg	110	4.5	8.3	ND(0.02)	51 J	220 J	720 J	550 J	23 J	64 J
PCB-156	ug/Kg	ND(0.10)	ND(0.11)	0.91 J	ND(0.09)	ND(0.10)	ND(0.10)	ND(1.1)	74 J	ND(0.08)	51 J
PCB-157	ug/Kg	ND(0.10)	ND(0.11)	5.4	0.87 J	ND(0.10)	ND(0.10)	440 J	380	ND(0.08)	ND(0.10)
PCB-167	ug/Kg	ND(0.10)	ND(0.11)	ND(0.11)	ND(0.09)	ND(0.10)	ND(0.10)	ND(1.1)	ND(1.1)	ND(0.08)	27
PCB-169	ug/Kg	ND(0.12)	ND(0.13)	ND(0.13)	ND(0.10)	ND(0.12)	ND(0.12)	ND(1.3)	ND(1.3)	ND(0.09)	17
PCB-170	ug/Kg	44 J	ND(0.02)	3.0 J	ND(0.02)	28 J	170 J	300 J	240 J	9.5 J	33 J
PCB-180	ug/Kg	75 J	3.1 J	5.1 J	0.83 J	46 J	270 J	450 J	390 J	16 J	54 J
PCB-187	ug/Kg	34 J	1.5 J	3.2 J	0.45 J	27 J	110 J	240 J	200 J	8.9 J	32 J
PCB-189	ug/Kg	ND(0.10)	ND(0.11)	ND(0.11)	ND(0.09)	ND(0.10)	ND(0.10)	ND(1.1)	ND(1.1)	ND(0.08)	ND(0.10)
PCB-195	ug/Kg	5.7	ND(0.02)	ND(0.02)	ND(0.02)	4.5 J	21 J	46 J	42 J	ND(0.02)	5.4 J
PCB-206	ug/Kg	3.5 J	ND(0.02)	ND(0.02)	ND(0.02)	2.7 J	10 J	25 J	23 J	ND(0.02)	4.3 J
PCB-209	ug/Kg	4	ND(0.02)	ND(0.02)	ND(0.02)	1.5 J	4.2 J	ND(0.22)	17 J	1.5 J	2.7 J
Total PCBs (18 congeners)	ug/Kg	612	37	51	4	290	1,669	5,176	3,343	144	474
Total PCBs (28 congeners)	ug/kg	665	40	58	6	343	1,730	5,616	3,797	144	724
POLYCHLORINATED BIPHENYLS (PCBs) - Aroclor Method											
Aroclor 1016	ug/kg	ND(20)	ND(21)	ND(21)	ND(17)	ND(20)	ND(20)	ND(21)	ND(22)	ND(15)	ND(19)
Aroclor 1221	ug/kg	ND(8.2)	ND(8.7)	ND(8.5)	ND(6.9)	ND(8.0)	ND(8.0)	ND(8.8)	ND(8.8)	ND(6.3)	ND(7.7)
Aroclor 1232	ug/kg	ND(8.2)	ND(8.7)	ND(8.5)	ND(6.9)	ND(8.0)	ND(8.0)	ND(8.8)	ND(8.8)	ND(6.3)	ND(7.7)
Aroclor 1242	ug/kg	ND(5.4)	ND(5.6)	ND(5.5)	ND(4.5)	ND(5.2)	ND(5.2)	ND(5.7)	ND(5.7)	ND(4.1)	ND(5.0)
Aroclor 1248	ug/kg	ND(2.9)	ND(3.0)	ND(3.0)	ND(2.4)	ND(2.8)	ND(2.8)	ND(3.1)	ND(3.1)	ND(2.2)	ND(2.7)
Aroclor 1254	ug/kg	1500 J	360 J	220 J	ND(2.8)	2200 J	11000 J	38000 J	13000 J	1000 J	ND(3.1)
Aroclor 1260	ug/kg	ND(7.4)	ND(7.8)	ND(7.7)	ND(6.2)	ND(7.2)	ND(7.2)	ND(7.9)	8800	ND(5.7)	2000
Total PCBs (Aroclor method)	ug/kg	1500	360	220	ND(6.9)	2200	11000	38000	21800	1000	2000
POLYCHLORINATED BIPHENYLS (PCBs) - Calculated Method											
Total PCBs (Calculated	ug/kg	1,600 E	96 E	140 E	14 E	820 E	4,100 E	13,000 E	9,000 E	340 E	1,700 E

Table C-3 Analytical Data (E&E, 2009).

Location ID: / Depth Interval (ft): / Sample Date:	Units:	YC-030 1 - 2 7/6/2009	YC-030 2 - 3 7/6/2009	YC-030 3 - 4 7/6/2009	YC-030 4 - 5 7/6/2009	YC-031 0 - 1 7/7/2009	YC-031 1 - 2 7/7/2009	YC-031 2 - 3 7/7/2009	YC-031 3 - 4 7/7/2009	YC-031 4 - 5 7/7/2009	YC-032 0 - 1 7/7/2009
PCB-118	ug/Kg	210 J	1000 J	120 J	5.9 J	57 J	540 J	69 J	3.0 J	ND(0.01)	1200 J
PCB-123	ug/Kg	ND(0.39)	ND(3.8)	ND(0.44)	ND(0.09)	ND(0.08)	ND(0.10)	ND(0.07)	4.1	ND(0.07)	ND(0.10)
PCB-126	ug/Kg	ND(0.39)	ND(3.8)	ND(0.44)	ND(0.09)	ND(0.08)	ND(0.10)	ND(0.07)	ND(0.07)	ND(0.07)	ND(0.10)
PCB-128	ug/Kg	93 J	470 J	71 J	2.4 J	42 J	340 J	ND(0.01)	ND(0.01)	ND(0.01)	400 J
PCB-138	ug/Kg	270 J	1400 J	200 J	7.4 J	120 J	850 J	400 J	ND(0.01)	ND(0.01)	1300 J
PCB-153	ug/Kg	270 J	1400 J	220 J	8.6 J	180 J	940 J	330 J	8.4 J	2.0 J	1300 J
PCB-156	ug/Kg	ND(0.39)	ND(3.8)	ND(0.44)	ND(0.09)	ND(0.08)	ND(0.10)	ND(0.07)	ND(0.07)	ND(0.07)	ND(0.10)
PCB-157	ug/Kg	ND(0.39)	960 J	170 J	4.9 J	ND(0.08)	ND(0.10)	59 J	2.9 J	ND(0.07)	750 J
PCB-167	ug/Kg	ND(0.39)	ND(3.8)	ND(0.44)	ND(0.09)	ND(0.08)	ND(0.10)	ND(0.07)	ND(0.07)	ND(0.07)	ND(0.10)
PCB-169	ug/Kg	ND(0.47	ND(4.5)	34	ND(0.11)	ND(0.10)	ND(0.11)	ND(0.09)	ND(0.09)	ND(0.08)	ND(0.12)
PCB-170	ug/Kg	110 J	590 J	99 J	3.2 J	54 J	430 J	38 J	1.7 J	ND(0.01)	510 J
PCB-180	ug/Kg	180 J	970 J	170 J	4.9 J	100 J	680 J	59 J	3.0 J	ND(0.01)	760 J
PCB-187	ug/Kg	93 J	500 J	78 J	2.9 J	65 J	400 J	85 J	3.3 J	0.82 J	410 J
PCB-189	ug/Kg	ND(0.39)	ND(3.8)	ND(0.44)	ND(0.09)	ND(0.08)	ND(0.10)	ND(0.07)	ND(0.07)	ND(0.07)	ND(0.10)
PCB-195	ug/Kg	18 J	110 J	23 J	ND(0.02)	11 J	ND(0.02)	10 J	ND(0.01)	ND(0.01)	55 J
PCB-206	ug/Kg	13 J	74 J	ND(0.09)	ND(0.02)	7.1 J	ND(0.02)	ND(0.01)	ND(0.01)	ND(0.01)	35 J
PCB-209	ug/Kg	8.6 J	ND(0.76)	9.0 J	ND(0.02)	3.5 J	ND(0.02)	ND(0.01)	ND(0.01)	ND(0.01)	21 J
Total PCBs (18 congeners)	ug/Kg	2,090	10,934	1,543	59	993	7,260	1,662	44	7.0	11,031
Total PCBs (28 congeners)	ug/kg	2,090	13,294	1,747	64	993	7,260	1,961	57	8.5	11,781
POLYCHLORINATED BIPHENYLS (PCBs) - Aroclor Method											
Aroclor 1016	ug/kg	ND(19)	ND(19)	ND(21)	ND(17)	ND(16)	ND(19)	ND(15)	ND(14)	ND(13)	ND(19)
Aroclor 1221	ug/kg	ND(7.8)	ND(7.6)	ND(8.7)	ND(7.1)	ND(6.7)	ND(7.6)	ND(6.0)	ND(5.7)	ND(5.4)	ND(7.9)
Aroclor 1232	ug/kg	ND(7.8)	ND(7.6)	ND(8.7)	ND(7.1)	ND(6.7)	ND(7.6)	ND(6.0)	ND(5.7)	ND(5.4)	ND(7.9)
Aroclor 1242	ug/kg	ND(5.0)	ND(4.9)	ND(5.7)	ND(4.6)	ND(4.3)	ND(4.9)	ND(3.9)	ND(3.7)	ND(3.5)	ND(5.2)
Aroclor 1248	ug/kg	ND(2.7)	ND(2.7)	ND(3.1)	ND(2.5)	ND(2.3)	ND(2.7)	ND(2.1)	ND(2.0)	ND(1.9)	ND(2.8)
Aroclor 1254	ug/kg	15000 J	24000 J	4300 J	780 J	3600 J	5200 J	2100 J	160 J	ND(2.2)	30000 J
Aroclor 1260	ug/kg	ND(7.0)	ND(6.8)	ND(7.8)	ND(6.4)	ND(6.0)	ND(6.8)	ND(5.4)	ND(5.1)	ND(4.9)	ND(7.1)
Total PCBs (Aroclor method)	ug/kg	15000	24000	4300	780	3600	5200	2100	160	ND(5.4)	30000
POLYCHLORINATED BIPHENYLS (PCBs) - Calculated Method											
Total PCBs (Calculated	ug/kg	5,000 E	32,000 E	4,200 E	150 E	2,400 E	17,000 E	4,700 E	130 E	20 E	28,000 E

Table C-3 Analytical Data (E&E, 2009).

Location ID:		YC-032	YC-032	YC-032	YC-032	YC-033	YC-033	YC-033	YC-033	YC-033	YC-034
Depth Interval (ft):		1 - 2	2 - 3	3 - 4	4 - 5	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	0 - 1
Sample Date:	Units:	7/7/2009	7/7/2009	7/7/2009	7/7/2009	7/8/2009	7/8/2009	7/8/2009	7/8/2009	7/8/2009	7/8/2009
PCB-118	ug/Kg	1700 J	39 J	4.3 J	ND(0.01)	9.1 J	41 J	34 J	50 J	ND(0.02)	6.9 J
PCB-123	ug/Kg	ND(10)	ND(0.06)	ND(0.06)	ND(0.07)	ND(0.09)	45	35	ND(1.9)	ND(0.09)	ND(0.09)
PCB-126	ug/Kg	ND(10)	ND(0.06)	ND(0.06)	ND(0.07)	ND(0.09)	ND(0.08)	ND(0.09)	ND(1.9)	ND(0.09)	ND(0.09)
PCB-128	ug/Kg	570 J	15 J	1.3 J	ND(0.01)	35 J	20 J	16 J	36 J	ND(0.02)	8.7 J
PCB-138	ug/Kg	3600 J	52 J	4.9 J	ND(0.01)	48 J	58 J	44 J	90 J	1.3 J	19 J
PCB-153	ug/Kg	3800 J	42 J	5.7 J	ND(0.01)	52 J	140 J	59 J	110 J	1.9 J	21 J
PCB-156	ug/Kg	ND(10)	7.1 J	ND(0.06)	ND(0.07)	17 J	ND(0.08)	ND(0.09)	80 J	ND(0.09)	ND(0.09)
PCB-157	ug/Kg	ND(10)	27 J	2.9 J	ND(0.07)	34 J	ND(0.08)	ND(0.09)	82 J	1.4 J	ND(0.09)
PCB-167	ug/Kg	ND(10)	ND(0.06)	ND(0.06)	ND(0.07)	ND(0.09)	ND(0.08)	ND(0.09)	37	ND(0.09)	8.9
PCB-169	ug/Kg	ND(12)	ND(0.08)	ND(0.07)	ND(0.08)	26 J	ND(0.10)	ND(0.11)	29 J	ND(0.11)	ND(0.11)
PCB-170	ug/Kg	2000 J	19 J	1.4 J	ND(0.01)	25 J	23 J	22 J	49 J	ND(0.02)	12 J
PCB-180	ug/Kg	3300 J	27 J	3.0 J	ND(0.01)	42 J	38 J	34 J	83 J	1.4 J	19 J
PCB-187	ug/Kg	1500 J	13 J	2.7 J	ND(0.01)	11 J	30 J	22 J	41 J	0.80 J	9.4 J
PCB-189	ug/Kg	ND(10)	ND(0.06)	ND(0.06)	ND(0.07)	ND(0.09)	ND(0.08)	ND(0.09)	ND(1.9)	ND(0.09)	ND(0.09)
PCB-195	ug/Kg	320 J	11 J	ND(0.01)	ND(0.01)	1.9 J	4.2 J	3.7 J	16 J	ND(0.02)	1.8 J
PCB-206	ug/Kg	150 J	ND(0.01)	ND(0.01)	ND(0.01)	1.3 J	2.7 J	2.5 J	ND(0.37)	ND(0.02)	1.2 J
PCB-209	ug/Kg	ND(2.0)	ND(0.01)	ND(0.01)	ND(0.01)	ND(0.02)	2.9	1.6	ND(0.37)	ND(0.02)	ND(0.02)
Total PCBs (18 congeners)	ug/Kg	23,790	386	42	ND(0.08)	273	629	420	722	7.4	136
Total PCBs (28 congeners)	ug/kg	23,790	433	46	ND(0.08)	436	793	535	1,007	8.8	178
POLYCHLORINATED BIPHENYLS (PCBs) - Aroclor Method											
Aroclor 1016	ug/kg	ND(390)	ND(12)	ND(12)	ND(13)	ND(17)	ND(15)	ND(17)	ND(18)	ND(17)	ND(18)
Aroclor 1221	ug/kg	ND(160)	ND(5.1)	ND(4.9)	ND(5.2)	ND(6.8)	ND(6.3)	ND(7.1)	ND(7.5)	ND(7.1)	ND(7.4)
Aroclor 1232	ug/kg	ND(160)	ND(5.1)	ND(4.9)	ND(5.2)	ND(6.8)	ND(6.3)	ND(7.1)	ND(7.5)	ND(7.1)	ND(7.4)
Aroclor 1242	ug/kg	ND(100)	ND(3.3)	ND(3.2)	ND(3.4)	ND(4.4)	ND(4.1)	ND(4.6)	ND(4.9)	ND(4.6)	ND(4.8)
Aroclor 1248	ug/kg	ND(56)	ND(1.8)	ND(1.7)	ND(1.8)	ND(2.4)	ND(2.2)	ND(2.5)	ND(2.6)	ND(2.5)	ND(2.6)
Aroclor 1254	ug/kg	68000 J	1500 J	360 J	ND(2.1)	1200 J	4500 J	4900 J	4600 J	220 J	970 J
Aroclor 1260	ug/kg	ND(140)	ND(4.6)	ND(4.4)	ND(4.7)	ND(6.2)	ND(5.7)	2800	ND(6.7)	ND(6.4)	ND(6.7)
Total PCBs (Aroclor method)	ug/kg	68000	1500	360	ND(5.2)	1200	4500	7700	4600	220	970
POLYCHLORINATED BIPHENYLS (PCBs) - Calculated Method											
Total PCBs (Calculated	ug/kg	57,000 E	1,000 E	110 E	ND (0.01) E	490 E	1,900 E	1,300 E	2,400 E	21 E	420 E

Table C-3 Analytical Data (E&E, 2009).

Location ID:		YC-034	YC-034	YC-034	YC-034	YC-035	YC-035	YC-035	YC-035	YC-035
Depth Interval (ft):		1 - 2	2 - 3	3 - 4	4 - 5	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5
Sample Date:	Units:	7/8/2009	7/8/2009	7/8/2009	7/8/2009	7/8/2009	7/8/2009	7/8/2009	7/8/2009	7/8/2009
PCB-118	ug/Kg	110 J	180 J	4.7 J	ND(0.02)	8.2 J	170 J	800 J	90 J	3.3 J
PCB-123	ug/Kg	ND(1.5)	ND(10)	ND(0.09)	ND(0.08)	ND(0.09)	ND(2.0)	ND(7.1)	ND(0.08)	ND(0.07)
PCB-126	ug/Kg	ND(1.5)	140	ND(0.09)	ND(0.08)	ND(0.09)	ND(2.0)	ND(7.1)	ND(0.08)	ND(0.07)
PCB-128	ug/Kg	43 J	180 J	2.9 J	ND(0.02)	8.1 J	60 J	410 J	17 J	ND(0.01)
PCB-138	ug/Kg	140 J	420 J	96 J	ND(0.02)	19 J	250 J	1300 J	240 J	6.0 J
PCB-153	ug/Kg	210 J	1200 J	20 J	ND(0.02)	20 J	200 J	3000 J	370 J	12 J
PCB-156	ug/Kg	ND(1.5)	69 J	ND(0.09)	ND(0.08)	2.3 J	29 J	190 J	28 J	ND(0.07)
PCB-157	ug/Kg	87 J	440 J	7.4 J	ND(0.08)	ND(0.09)	120 J	990 J	250 J	4.1 J
PCB-167	ug/Kg	ND(1.5)	ND(10)	ND(0.09)	ND(0.08)	ND(0.09)	ND(2.0)	ND(7.1)	ND(0.08)	ND(0.07)
PCB-169	ug/Kg	74 J	ND(12)	2.9 J	ND(0.10)	ND(0.10)	ND(2.4)	ND(8.5)	30 J	ND(0.09)
PCB-170	ug/Kg	60 J	420 J	4.8 J	ND(0.02)	10 J	76 J	600 J	140 J	2.6 J
PCB-180	ug/Kg	88 J	440 J	7.5 J	ND(0.02)	16 J	120 J	1000 J	250 J	4.1 J
PCB-187	ug/Kg	78 J	540 J	8.9 J	ND(0.02)	9.6 J	65 J	1100 J	150 J	5.2 J
PCB-189	ug/Kg	ND(1.5)	ND(10)	ND(0.09)	ND(0.08)	ND(0.09)	ND(2.0)	ND(7.1)	ND(0.08)	ND(0.07)
PCB-195	ug/Kg	10 J	74 J	1.5 J	ND(0.02)	1.7 J	12 J	110 J	22 J	ND(0.01)
PCB-206	ug/Kg	7.5 J	ND(2.0)	ND(0.02)	ND(0.02)	1.2 J	10 J	67 J	8.7 J	ND(0.01)
PCB-209	ug/Kg	ND(0.30)	ND(2.0)	ND(0.02)	ND(0.02)	ND(0.02)	ND(0.39)	ND(1.4)	4.1	ND(0.01)
Total PCBs (18 congeners)	ug/Kg	1,453	6,012	194	ND(0.10)	138	1,983	13,877	1,919	61
Total PCBs (28 congeners)	ug/kg	1,804	8,121	216	ND(0.10)	157	2,308	17,257	2,227	74
POLYCHLORINATED BIPHENYLS (PCBs) - Aroclor Method										
Aroclor 1016	ug/kg	ND(15)	200	ND(17)	ND(16)	ND(17)	ND(19)	ND(140)	ND(15)	ND(15)
Aroclor 1221	ug/kg	ND(6.1)	80	ND(7.1)	ND(6.5)	ND(6.9)	ND(7.8)	ND(57)	ND(6.1)	ND(6.0)
Aroclor 1232	ug/kg	ND(6.1)	80	ND(7.1)	ND(6.5)	ND(6.9)	ND(7.8)	ND(57)	ND(6.1)	ND(6.0)
Aroclor 1242	ug/kg	ND(3.9)	52	ND(4.6)	ND(4.2)	ND(4.5)	ND(5.1)	ND(37)	ND(4.0)	ND(3.9)
Aroclor 1248	ug/kg	ND(2.1)	28	ND(2.5)	ND(2.3)	ND(2.4)	ND(2.7)	ND(20)	ND(2.1)	ND(2.1)
Aroclor 1254	ug/kg	5100 J	25000 J	430 J	42 J	2800 J	9000 J	24000 J	2100 J	170 J
Aroclor 1260	ug/kg	ND(5.5)	21000	ND(6.4)	ND(5.8)	ND(6.2)	ND(7.1)	16000	1600	ND(5.4)
Total PCBs (Aroclor method)	ug/kg	5100	46440	430	42	2800	9000	40000	3700	170
POLYCHLORINATED BIPHENYLS (PCBs) - Calculated Method										
Total PCBs (Calculated	ug/kg	4,300 E	19,000 E	510 E	ND (0.01) E	370 E	5,500 E	41,000 E	5,300 E	180 E

Table C-3 Analytical Data (E&E, 2009).

Location ID: / Depth Interval (ft): / Sample Date:	Units:	YC-036 0 - 1 7/9/2009	YC-036 1 - 2 7/9/2009	YC-036 2 - 3 7/9/2009	YC-036 3 - 4 7/9/2009
PCB-118	ug/Kg	890 J	780 J	40 J	2.5 J
PCB-123	ug/Kg	ND(3.8)	ND(8.2)	ND(0.07)	ND(0.06)
PCB-126	ug/Kg	ND(3.8)	ND(8.2)	ND(0.07)	ND(0.06)
PCB-128	ug/Kg	270 J	780 J	19 J	0.93 J
PCB-138	ug/Kg	1000 J	1800 J	110 J	3.2 J
PCB-153	ug/Kg	830 J	1900 J	230 J	3.2 J
PCB-156	ug/Kg	150 J	320 J	20 J	ND(0.06)
PCB-157	ug/Kg	460 J	1600	190 J	2.1 J
PCB-167	ug/Kg	ND(3.8)	ND(8.2)	ND(0.07)	ND(0.06)
PCB-169	ug/Kg	220 J	ND(9.8)	31 J	ND(0.07)
PCB-170	ug/Kg	290 J	970 J	34 J	1.3 J
PCB-180	ug/Kg	460 J	1600 J	190 J	2.1 J
PCB-187	ug/Kg	220 J	780 J	85 J	1.1 J
PCB-189	ug/Kg	ND(3.8)	ND(8.2)	ND(0.07)	ND(0.06)
PCB-195	ug/Kg	44 J	170 J	8.3 J	ND(0.01)
PCB-206	ug/Kg	37 J	76 J	6.0 J	ND(0.01)
PCB-209	ug/Kg	43	36 J	5.3	ND(0.01)
Total PCBs (18 congeners)	ug/Kg	7,378	13,184	995	24
Total PCBs (28 congeners)	ug/kg	10,448	16,104	1,325	27
POLYCHLORINATED BIPHENYLS (PCBs) - Aroclor Method					
Aroclor 1016	ug/kg	ND(19)	ND(160)	ND(13)	ND(12)
Aroclor 1221	ug/kg	ND(7.7)	ND(65)	ND(5.3)	ND(4.9)
Aroclor 1232	ug/kg	ND(7.7)	ND(65)	ND(5.5)	ND(4.9)
Aroclor 1242	ug/kg	ND(5.0)	ND(43)	ND(3.5)	ND(3.2)
Aroclor 1248	ug/kg	ND(2.7)	ND(23)	ND(1.9)	ND(1.7)
Aroclor 1254	ug/kg	19000 J	25000 J	1000 J	130 J
Aroclor 1260	ug/kg	ND(6.9)	18000	ND(5.0)	ND(4.4)
Total PCBs (Aroclor method)	ug/kg	19000	43000	1000	130
POLYCHLORINATED BIPHENYLS (PCBs) - Calculated Method					
Total PCBs (Calculated	ug/kg	25,000 E	38,000 E	2,100 E	63 E

Notes:

1. Reference: Ecology and Environment, Inc. (E & E). 2011. Yosemite Creek Sediment Removal Assessment Report (Final). Prepared for U.S. Environmental Protection Agency Region IX, San Francisco, California. May 2011.
2. ND(0.09) - compound not detected. Value in parentheses represents the reported detection limit.
3. J - detected result was between the method reporting limit and the reported detection limit.
4. E - Estimated value based on recalaulation of concentrations of Aroclor 1254 and Aroclor 1260 mixtures, and quantitation of 28 congeners.

Table C-4 Analytical Data (E&E, 2012).

Location ID:		YC-038	YC-038	YC-038	YC-038	YC-039	YC-039	YC-039	YC-039
Depth Interval (ft):		0 - 1	1 - 2	2 - 3	3 - 3.5	0 - 1	1 - 2	2 - 3	3 - 3.25
Sample Date:	Units:	2/21/2012	2/21/2012	2/21/2012	2/21/2012	2/21/2012	2/21/2012	2/21/2012	2/21/2012
METALS									
Antimony	mg/kg	ND(1.9)	2.1	ND(2.6)	ND(2.6)	ND(4.6)	ND(3.7)	2.4	ND(2.7)
Arsenic	mg/kg	8.7	7.1	6.9	7.4	12	7.0	13	11
Barium	mg/kg	150	260	36	38	250	200	260	71
Beryllium	mg/kg	0.51	0.42	0.31	0.31	0.7	0.41	0.41	0.31
Cadmium	mg/kg	2.3	10	0.36	ND(0.64)	5.6	5.5	2.8	0.7
Chromium	mg/kg	150	330	49	48	280	290	150	73
Chromium (Hexavalent)	mg/kg	ND(58)	ND(53)	ND(40)	ND(37)	ND(70)	ND(54)	ND(43)	ND(42)
Cobalt	mg/kg	12	15	8.0	7.7	17	13	13	10
Copper	mg/kg	90	71	16	15	140	110	70	26
Lead	mg/kg	330	650	27	16	760	440	460	87
Mercury	mg/kg	1.2	1.5	0.15	0.4	1.9	1.1	0.87	0.36
Molybdenum	mg/kg	ND(4.8)	ND(8.9)	ND(6.5)	ND(6.4)	ND(11)	ND(9.1)	ND(7.2)	ND(6.7)
Nickel	mg/kg	75	60	30	33	120	76	73	48
Selenium	mg/kg	ND(1.9)	2.4	ND(2.6)	ND(2.6)	ND(4.6)	ND(3.7)	ND(2.9)	ND(2.7)
Silver	mg/kg	1.1	1.2	ND(1.3)	ND(1.3)	1.6	0.95	0.94	ND(1.3)
Thallium	mg/kg	ND(4.8)	ND(8.9)	ND(6.5)	ND(6.4)	ND(11)	ND(9.1)	ND(7.2)	ND(6.7)
Vanadium	mg/kg	75	74	62	49	99	71	71	52
Zinc	mg/kg	320	480	56	48	660	360	470	110
ASBESTOS									
Asbestos	%	ND	ND	ND	ND	ND	ND	ND	NA
POLYCHLORINATED BIPHENYLS (PCBs) - Aroclor Method									
Aroclor 1016	ug/kg	ND(58)	ND(53)	ND(40)	ND(37)	ND(70)	ND(54)	ND(43)	ND(42)
Aroclor 1221	ug/kg	ND(120)	ND(110)	ND(81)	ND(74)	ND(140)	ND(110)	ND(86)	ND(83)
Aroclor 1232	ug/kg	ND(58)	ND(53)	ND(40)	ND(37)	ND(70)	ND(54)	ND(43)	ND(42)
Aroclor 1242	ug/kg	ND(58)	ND(53)	ND(40)	ND(37)	ND(70)	ND(54)	ND(43)	ND(42)
Aroclor 1248	ug/kg	ND(58)	ND(53)	ND(40)	ND(37)	ND(70)	ND(54)	ND(43)	ND(42)
Aroclor 1254	ug/kg	3,600	21,000	970	ND(37)	12,000	15,000	4,800	ND(42)
Aroclor 1260	ug/kg	2,400	17,000	660	78	3,200	17,000	3,400	340
Aroclor 1262	ug/kg	ND(58)	ND(53)	ND(40)	ND(37)	ND(70)	ND(54)	ND(43)	ND(42)
Aroclor 1268	ug/kg	ND(58)	ND(53)	ND(40)	ND(37)	ND(70)	ND(54)	ND(43)	ND(42)
Total PCBs (Aroclor method)	ug/kg	6,000	38,000	1,630	78	15,200	32,000	8,200	340

Table C-4 Analytical Data (E&E, 2012).

Location ID:		YC-040	YC-040	YC-040	YC-040	YC-041	YC-041	YC-041	YC-041
Depth Interval (ft):		0 - 1	1 - 2	2 - 3	3 - 3.5	0 - 1	1 - 2	2 - 3	3 - 4
Sample Date:	Units:	2/21/2012	2/21/2012	2/21/2012	2/21/2012	2/21/2012	2/21/2012	2/21/2012	2/21/2012
METALS									
Antimony	mg/kg	ND(4.7)	ND(3.3)	ND(2.5)	4.0	ND(3.8)	4.5	9.4	ND(4.2)
Arsenic	mg/kg	10	7.6	3.4	5.1	10	11	12	9.0
Barium	mg/kg	100	76	59	160	150	230	720	320
Beryllium	mg/kg	0.69	0.48	0.23	0.31	0.57	0.54	0.47	0.49
Cadmium	mg/kg	0.71	0.89	1.1	3.2	0.94	3.2	9.1	8.5
Chromium	mg/kg	130	110	110	170	130	200	360	440
Chromium (Hexavalent)	mg/kg	ND(69)	ND(47)	ND(35)	ND(48)	ND(58)	ND(55)	ND(59)	ND(67)
Cobalt	mg/kg	14	11	7.4	11	13	13	16	13
Copper	mg/kg	94	86	39	110	99	240	260	130
Lead	mg/kg	130	110	150	460	180	550	2,800	650
Mercury	mg/kg	0.58	0.55	0.32	1.1	0.48	0.99	1.8	1.3
Molybdenum	mg/kg	ND(12)	ND(8.3)	ND(6.2)	ND(8.2)	ND(9.4)	ND(8.8)	5.4	ND(10)
Nickel	mg/kg	91	69	38	72	89	120	160	83
Selenium	mg/kg	ND(4.7)	ND(3.3)	ND(2.5)	ND(3.3)	ND(3.8)	ND(3.5)	ND(3.7)	ND(4.2)
Silver	mg/kg	ND(2.3)	ND(1.7)	ND(1.2)	1.5	0.96	1.5	3.4	1.4
Thallium	mg/kg	ND(12)	ND(8.3)	ND(6.2)	ND(8.2)	ND(9.4)	ND(8.8)	ND(9.3)	ND(10)
Vanadium	mg/kg	89	74	50	79	81	75	72	71
Zinc	mg/kg	210	190	210	420	270	650	1,200	550
ASBESTOS									
Asbestos	%	ND	ND	ND	<1% chrysotile	<1% chrysotile	ND	ND	ND
POLYCHLORINATED BIPHENYLS (PCBs) - Aroclor Method									
Aroclor 1016	ug/kg	ND(69)	ND(47)	ND(35)	ND(48)	ND(58)	ND(55)	ND(59)	ND(67)
Aroclor 1221	ug/kg	ND(140)	ND(94)	ND(69)	ND(96)	ND(120)	ND(110)	ND(120)	ND(130)
Aroclor 1232	ug/kg	ND(69)	ND(47)	ND(35)	ND(48)	ND(58)	ND(55)	ND(59)	ND(67)
Aroclor 1242	ug/kg	ND(69)	ND(47)	ND(35)	ND(48)	ND(58)	ND(55)	ND(59)	ND(67)
Aroclor 1248	ug/kg	ND(69)	ND(47)	ND(35)	ND(48)	ND(58)	ND(55)	ND(59)	ND(67)
Aroclor 1254	ug/kg	1,200	830	2,800	15,000	660	5,100	29,000	16,000
Aroclor 1260	ug/kg	1,000	600	1,500	6,400	570	2,700	2,700	30,000
Aroclor 1262	ug/kg	ND(69)	ND(47)	ND(35)	ND(48)	ND(58)	ND(55)	ND(59)	ND(67)
Aroclor 1268	ug/kg	ND(69)	ND(47)	ND(35)	ND(48)	ND(58)	ND(55)	ND(59)	ND(67)
Total PCBs (Aroclor method)	ug/kg	2,200	1,430	4,300	21,400	1,230	7,800	31,700	46,000

Notes:

1. Reference: Ecology and Environment, Inc. (E & E). 2012. Yosemite Creek Sediment Waste Characterization Study Report (Final). Prepared for U.S. Environmental Protection Agency Region IX, San Francisco, California. October 2012.
2. ND(0.09) - compound not detected. Value in parentheses represents the reported detection limit.
3. J - detected result was between the method reporting limit and the reported detection limit.

Table C-5 Analytical Data (NewFields, 2012).

Location ID Depth Interval (ft) Sample Date		TS-038 Bulk 4/6/2012	TS-040 Bulk 4/6/2012	TS-041 Bulk 4/4/2012	TS-042 Bulk 4/3/2012
METALS					
Aluminum	mg/kg	20,700	12,800	24,500	31,800
Arsenic	mg/kg	8.7	6.6	11.9	14.2
Cadmium	mg/kg	4.90	2.80	7.00	2.30
Chromium	mg/kg	165	146	321	193
Copper	mg/kg	86	76	201	97
Iron	mg/kg	30,400	21,800	32,100	39,800
Lead	mg/kg	436	282	763	162
Manganese	mg/kg	254	213	296	342
Mercury	mg/kg	1.40	0.72	0.98	0.48
Nickel	mg/kg	72	56	106	102
Selenium	mg/kg	ND(4.1)	ND(3.2)	ND(4.1)	ND(4.9)
Silver	mg/kg	2.20	24.8	1.50	ND(1.2)
Zinc	mg/kg	350	310	616	268
POLYNUCLEAR AROMATIC HYDROCARBONS (PAHs)					
TPH-DRO (C10-C44)	mg/kg	937	536	959	343
PESTICIDES					
Aldrin	ug/kg	ND(4.4)	ND(0.55)	ND(0.73)	ND(0.77)
alpha-BHC	ug/kg	ND(6.6)	ND(0.82)	ND(1.1)	ND(1.2)
beta-BHC	ug/kg	ND(6.2)	ND(0.77)	ND(1.0)	ND(1.1)
delta-BHC	ug/kg	ND(5.1)	ND(0.64)	ND(0.86)	ND(0.90)
gamma-BHC (Lindane)	ug/kg	ND(4.0)	ND(0.50)	ND(0.67)	ND(0.70)
alpha-Chlordane	ug/kg	ND(5.7)	ND(0.71)	ND(0.96)	ND(1.0)
gamma-Chlordane	ug/kg	ND(4.5)	ND(0.56)	ND(0.75)	ND(0.79)
Dieldrin	ug/kg	ND(6.8)	ND(0.85)	ND(1.1)	ND(1.2)
4,4'-DDD	ug/kg	ND(4.5)	ND(0.56)	ND(0.75)	ND(0.79)
4,4'-DDE	ug/kg	ND(5.2)	161	ND(0.87)	ND(0.91)
4,4'-DDT	ug/kg	ND(6.5)	ND(0.80)	ND(1.1)	ND(1.1)
Endrin	ug/kg	ND(4.5)	ND(0.56)	ND(0.75)	ND(0.79)
Endosulfan sulfate	ug/kg	ND(8.0)	ND(0.99)	ND(1.3)	ND(1.4)
Endrin aldehyde	ug/kg	ND(8.3)	ND(1.0)	ND(1.4)	ND(1.5)
Endosulfan-I	ug/kg	ND(4.3)	ND(0.53)	ND(0.71)	ND(0.75)
Endosulfan-II	ug/kg	ND(5.8)	ND(0.72)	ND(0.97)	ND(1.0)
Heptachlor	ug/kg	ND(5.4)	ND(0.67)	ND(0.90)	ND(0.94)
Heptachlor epoxide	ug/kg	ND(4.3)	ND(0.54)	ND(0.72)	ND(0.76)
Methoxychlor	ug/kg	ND(6.2)	ND(0.77)	ND(1.0)	ND(1.1)
Endrin ketone	ug/kg	ND(5.7)	ND(0.71)	ND(0.95)	ND(1.0)
Toxaphene	ug/kg	ND(110)	ND(14)	ND(19)	ND(19)
POLYCHLORINATED BIPHENYLS (PCBs) - Congener Method					
PCB-8	ug/kg	ND(240)	ND(21)	ND(28)	ND(3.5)
PCB-18	ug/kg	ND(200)	ND(17)	56.2 J	ND(2.8)
BCB-28	ug/kg	ND(110)	ND(9.0)	43	ND(1.5)
PCB-44	ug/kg	1,460 a	142	182	10
PCB-49	ug/kg	3,160 a	272	424	11
PCB-52	ug/kg	4,320	364	488	20
PCB-66	ug/kg	1,500 a	172	286	8.6 a
PCB-77	ug/kg	ND(3,000)b	ND(160)b	ND(86)b	ND(16) b
PCB-81	ug/kg	10,100	591	823	89
PCB-87	ug/kg	5,170 a	219 a	284 a	30
PCB-101	ug/kg	6,190	581	1,070	83
PCB-105	ug/kg	1,900	92	105	13
PCB-118	ug/kg	4,920	362	551	35

Table C-5 Analytical Data (NewFields, 2012).

Location ID Depth Interval (ft) Sample Date		TS-038 Bulk 4/6/2012	TS-040 Bulk 4/6/2012	TS-041 Bulk 4/4/2012	TS-042 Bulk 4/3/2012
PCB-123	ug/kg	359 Ja	32	56	3.4 J
PCB-126	ug/kg	ND(75)	ND(6.4)	ND(8.6)	ND(1.1)
PCB-128	ug/kg	1,170	79.4 a	136 a	17.5 a
PCB-138	ug/kg	5,370	474	885	122
PCB-151	ug/kg	886	150	264	31
PCB-153	ug/kg	4,460	705	1,140	136
PCB-156	ug/kg	628	42	69	8
PCB-157	ug/kg	274 J	27.2 J	58	9
PCB-167	ug/kg	221 Ja	16.1 Ja	54	ND(1.7) a
PCB-169	ug/kg	ND(740)b	ND(64) b	ND(130) b	ND(16) b
PCB-170	ug/kg	1,070	160	405	61
PCB-180	ug/kg	1,570	257	647	102
PCB-183	ug/kg	574	88	195	34
PCB-184	ug/kg	ND(84)	ND(7.1)	ND(9.6)	ND(1.2)
PCB-187	ug/kg	917	204	386	60
PCB-189	ug/kg	ND(75)	15.1 J	ND(43)	5.6
PCB-195	ug/kg	87.4 J	15.1 J	36.4 J	5.6
PCB-206	ug/kg	ND(75)	13.5 J	29.8 J	5 J
PCB-209	ug/kg	ND(75)	ND(6.4)	11 J	2.3 J
Total PCBs (18 congeners)	ug/kg	34,900	3,600	6,500	700
Total PCBs (all congeners)	ug/kg	56,300	5,100	8,700	900
POLYCHLORINATED BIPHENYLS (PCBs) - Aroclor Method					
Aroclor 1016	ug/kg	ND(110)	ND(14)	ND(19)	ND(20)
Aroclor 1221	ug/kg	ND(260)	ND(33)	ND(44)	ND(46)
Aroclor 1232	ug/kg	ND(220)	ND(28)	ND(0.39)	ND(0.39)
Aroclor 1242	ug/kg	ND(140)	ND(17)	ND(23)	ND(24)
Aroclor 1248	ug/kg	3,080	ND(17)	ND(22)	ND(23)
Aroclor 1254	ug/kg	11,300	5,580	5,710	223
Aroclor 1260	ug/kg	2,820	1,550	3,310	251
Aroclor 1268	ug/kg	ND(130)	ND(16)	ND(22)	ND(23)
Aroclor 1262	ug/kg	ND(140)	ND(17)	ND(23)	ND(24)
Total PCBs (Aroclor method)	ug/kg	17,200	7,130	9,020	474

Notes:

1. Reference: NewFields, LLC, 2012. DRAFT Sediment Treatability Study for Yosemite Slough Sediment Area. September.
2. ND(0.09) - compound not detected. Value in parentheses represents the reported detection limit.
3. J - detected result was between the method reporting limit and the reported detection limit.
4. a - Primary and confirmation results differ by more than 40%. Lower value reported due to possible coelution.
5. b - Elevated reporting limit due to matrix interference.

D 2011-2012 Technical Studies

[Provided on CD-ROM]

E

Site Analytical Database

[Provided on CD-ROM]

F

Applicable or Relevant and Appropriate Requirements

F.1 Introduction

This appendix identifies potential federal and state of California applicable or relevant and appropriate requirements (ARARs) for the recommended removal alternative (Alternative 5) identified in the Engineering Evaluation/Cost Analysis (EE/CA) for the Yosemite Slough Site (Site) located in San Francisco, California. This evaluation includes: (1) an initial determination of whether potential ARARs actually qualify as ARARs; and (2) a comparison for stringency between the federal and state regulations to identify the controlling ARARs. The identification of ARARs is an iterative process. The final determination will be made by the United States Environmental Protection Agency (EPA) in its Action Memorandum after public review of the Draft EE/CA, as part of the response action selection process.

F.1.1 Summary of Comprehensive Environmental Response, Compensation, and Liability Act and National Oil and Hazardous Substances Pollution Contingency Plan Requirements

In accordance with Sections 104 and 106 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), Title 40 Code of Federal Regulations (CFR) § 300-415(j) states that removal actions must attain ARARs to the extent practicable. Section 300.5 of the NCP defines applicable requirements as cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal environmental or state environmental, or facility citing laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. Section 300.5 of the NCP defines relevant and appropriate requirements as cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental, or state environmental, or facility citing laws that, while not "applicable" to a hazardous substance, pollutant, or contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site and are well suited to the particular site.

Because CERCLA on-site response actions do not require permitting, only substantive requirements are considered as possible ARARs. Administrative requirements, such as approval of or consultation with administrative bodies, issuance of permits, documentation, reporting, recordkeeping, and enforcement are not ARARs for CERCLA actions confined to the site.

ARARs must be identified on a site-specific basis from information about specific chemicals at the site, specific features of the site location, and actions that are considered removal actions.

As the lead federal agency, the EPA has primary responsibility for identifying federal ARARs at the Site. In October 2011, the EPA sent notification letters to federal and State Natural Resource Trustees (i.e., National Oceanic and Atmospheric Administration [NOAA], United States Fish and Wildlife Service [USFWS] and the California Department of Fish and Game [CDFG]), and State of California regulatory agencies (i.e., the Department of Toxic Substances Control [DTSC], the San Francisco Bay Regional Water Quality Control Board [Water Board], and the San Francisco Bay Conservation and Development Commission [BCDC]), requesting assistance to identify potential ARARs relevant to Yosemite Slough.

An applicable federal requirement is an ARAR. An applicable state requirement is an ARAR only if it is more stringent than a similar federal ARAR. If the requirement is not legally applicable, then the requirement is evaluated to determine whether it is relevant and appropriate. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not applicable, address problems or situations similar to the circumstances of the proposed response action and are well suited to the conditions of the site. A requirement must be determined to be both relevant and appropriate to be considered an ARAR.

The following criteria for determining relevance and appropriateness are listed in Title 40 Code of Federal Regulations (CFR) § 300.400(g)(2).

- The purpose of the requirement and the purpose of the CERCLA action;
- The medium regulated or affected by the requirement and the medium contaminated or affected at the CERCLA site;
- The substances regulated by the requirement and the substances found at the CERCLA site;
- Any variances, waivers, or exemptions of the requirement and their availability for the circumstances at the CERCLA site;
- The type of place regulated and the type of place affected by the release or CERCLA action;
- The type and size of structure or facility regulated and the type and size of structure or facility affected by the release or contemplated by the CERCLA action; and
- Any consideration of use or potential use of affected resources in the requirement and the use or potential use of the affected resources at the CERCLA site.

The substantive provisions of the requirements were identified as potential federal and state chemical-, location-, and action-specific ARARs for the Site. The potential ARARs for this EE/CA are presented in Tables F-1, F-2, and F-3. The potential ARARs in Tables F-1, F-2, and F-3 apply to all removal action alternatives that underwent a detailed evaluation in the EE/CA with the exception of the No Action alternative which has no ARARs.

Each potential ARAR is assigned with a determination of status (i.e., applicable or relevant and appropriate). For the determination of relevance and appropriateness, the pertinent criteria were examined to determine whether the requirements addressed problems or situations sufficiently similar to the circumstances of the release or response action contemplated, and whether the requirement was well suited to the Site.

To qualify as a California State ARAR under CERCLA and the NCP, a state requirement must be:

- A state law;
- An environmental or facility siting law;
- Promulgated (of general applicability and legally enforceable);
- Substantive (not procedural or administrative);
- More stringent than the federal requirement;
- Identified in a timely manner; and
- Consistently applied.

To constitute an ARAR, a requirement must be substantive. Therefore, only the substantive provisions of requirements identified as ARARs in this analysis are considered to be ARARs. Permits are considered to be procedural or administrative requirements. Provisions of generally relevant federal and state statutes and regulations that were determined to be procedural or not environmental, including permit requirements, are not considered to be ARARs. CERCLA §121(e)(1) (42 United States Code § 9621[e][1]), states that, "No Federal, State, or local permit shall be required for the portion of any removal or remedial action conducted entirely on-site, where such remedial action is selected and carried out in compliance with this section."[6] The term "on-site" is defined for purposes of this ARARs discussion as "the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action" (40 CFR § 300.5). Pursuant to the definition of the term "on-site" in 40 CFR § 300.5, the EPA determined that "on-site" at the Site is considered to be within the Site boundaries as defined in Figure 2-1 of the EECA and further described in Section 2. In addition, EPA has determined the following areas to also be considered "on-site":

- The banks of Yosemite Slough as needed to construct bank stability aspects of the selected removal action;

- Those areas identified by the EPA in need of improved stormwater management for purposes to prevent potential re-contamination of the Site;

- Project staging areas needed to implement and oversee the response action work identified in the EE/CA and finalized during the response action design; and,

- The dredged materials stockpile areas including sediment dewatering locations tentatively identified in the EE/CA and finalized during the response action design.

Nonpromulgated advisories or guidance issued by federal or state governments are not legally binding and do not have the status of ARARs. However, such requirements may be useful, and are "to-be-considered" criteria (40 CFR § 300.400[g][3]). To-be-considered criteria complement ARARs, but do not override them. They are useful for guiding decisions on cleanup levels or methodologies when regulatory standards are not available.

Table F-1 Potential Federal and State Chemical-Specific[a] Applicable or Relevant and Appropriate Requirements
Engineering Evaluation/Cost Analysis, Yosemite Slough, San Francisco, California

Requirement	Prerequisite	Citation[b]	Preliminary ARAR Determination	Comments
Sediment				
Federal Requirements				
Resource Conservation and Recovery Act (42 USC, ch. 82, §§ 6901 through 6991[i])[c]				
Defines RCRA hazardous waste. A solid waste is characterized as toxic, based on the toxicity characteristic leaching procedure, if the waste exceeds the toxicity characteristic leaching procedure maximum concentrations.	Waste	California Code of Regulations (CCR) title 22, § 66261.100	Applicable	Applicable for determining whether waste is hazardous.
Toxic Substances Control Act (15 USC, ch. 53, §§ 2601 through 2692)				
Regulates storage and disposal of PCB remediation waste found in sediments.	Sediments located in marine ecosystems contaminated with PCBs	40 CFR § 761(c)	Relevant and appropriate	EPA must approve any plans requiring sampling, cleanup, disposal, or storage of PCB contaminated sediments in marine ecosystems. PCB remediation cleanup methods and standards set based upon risk and approved by EPA.
State Requirements				
State and Regional Water Quality Control Boards[c]				
Definition of "non-RCRA hazardous waste"	Waste	CCR title 22, § 66261.101	Applicable	Applicable for determining whether a waste is a non-RCRA hazardous waste.
Definitions of designated waste, nonhazardous waste and inert waste	Waste	CCR title. 27, §§20210, 20220, and 20230	Applicable	Potential ARAR for classifying waste. These soil classifications determine state classification and siting requirements for discharging waste to land.

Table F-1 Potential Federal and State Chemical-Specific[a] Applicable or Relevant and Appropriate Requirements
Engineering Evaluation/Cost Analysis, Yosemite Slough, San Francisco, California

Requirement	Prerequisite	Citation[b]	Preliminary ARAR Determination	Comments
Surface Water				
Federal Requirements				
Discharges to waters of the United States	Impact to surface water	Water Quality Standards, National Toxics Rule and California Toxics Rule 40 CFR §§ 131.36(b) and 131.38	Applicable	Potentially applicable to the discharge of contaminants to surface water expected during dredging. Water quality criteria under this potential ARAR together with the State's existing water quality standards shall be used when controlling pollution in inland waters and enclosed bays and estuaries.
Discharges to waters of the United States	Impact to surface water	National Pollutant Discharge Elimination System permits. 33 USC § 1342 (a) and (q); 40 CFR Part 122, Subpart C	Relevant and Appropriate	Discharges of municipal combined sewer overflows into the Slough are potentially relevant and appropriate to the design of the remedy and to maintain the integrity of the remedy.
State and Regional Water Quality Control Boards[c]				
Beneficial use of surface water in San Francisco Bay. Establishes water quality objectives including narrative and numerical standards.	Impact to surface water	Comprehensive Water Quality Control Plan for the San Francisco Bay Basin (as required by the Porter-Cologne Water Quality Control Act, Cal. Water Code § 13240) Chapter 2 Beneficial Uses, Chapter 3 Water Quality Objectives for turbidity, dissolved oxygen, and toxicity (see Basin Plan Tables 3-3 and 3-3B.	Applicable	Substantive requirements pertaining to beneficial uses and water quality objectives for turbidity, dissolved oxygen and toxicity are potentially applicable during dredging activities. Beneficial uses for Yosemite Slough include: commercial and sport fishing; estuarine habitat; contact and noncontact water recreation; and wildlife habitat.

Notes:
[a] Many potential action-specific ARARs contain chemical-specific limitations and are addressed in Table E-2, Potential Action-Specific ARARs.
[b] Only the substantive provisions of the requirements cited in this table are potential ARARs.
[c] Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the EPA has determined that the entire statutes or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only pertinent substantive requirements of specific citations are considered potential ARARs.

Key:
§ = Section
ARAR = Applicable or relevant and appropriate requirement
CCR = California Code of Regulations
CFR = Code of Federal Regulations
ch. = Chapter
mg/kg = milligram per kilogram
PCB = polychlorinated biphenyl
ppm = part per million
RCRA = Resource Conservation and Recovery Act
USC = United States Code

Table F-2 Potential Federal and State Location-Specific Applicable or Relevant and Appropriate Requirements
Engineering Evaluation/Cost Analysis, Yosemite Slough, San Francisco, California

Location	Requirement	Prerequisite	Citation[a]	Preliminary ARAR Determination[a]	Comments
Biological Resources – Federal Requirements					
Migratory bird area	Protects almost all species of native migratory birds in the United States from an unregulated "take," of designated migratory birds, nests, eggs and young.	Presence of migratory birds	Migratory Bird Treaty Act of 1972, 16 USC §703	Relevant and appropriate	The substantive portions are relevant and appropriate as migratory birds have been observed at the site. Response actions will be designed to avoid "take".
Marine mammal area	Protects any marine mammal in the United States except as provided by international treaties from an unregulated "taking.	Presence of marine mammals	Marine Mammal Protection Action 16 USC §§ 1362(13) and 1372(a)(2)	Relevant and Appropriate	Marine mammals are known to be present near Yosemite Slough, thus substantive provisions are relevant and appropriate if the selected response action constitutes a taking.
Federally protected species area	Prohibits "take" of Federal Endangered Species Act protected species. Requires Federal Agency review of actions. Allows for either formal or informal consultation with USFWS	Presence of Federally protected species	Endangered Species Act 16 USC §§ 1531 - 1543	Applicable	California Clapper Rail and the Green Sturgeon are two federally protective species that have not been identified at the Site but they may visit or inhabit the Site in the future.
Coastal Resources – Federal Requirements					
(Title 16 USC §§ 1451 through 1464)					
Within coastal zone	Conduct activities in a manner consistent with approved state management programs	Activities affecting the coastal zone, including lands there under and adjacent shore land	Coastal Zone Management Act 16 USC § 1456(c), 15 CFR Part 930	Relevant and appropriate	Potentially relevant because response actions at the Site may affect a coastal zone.

Table F-2 Potential Federal and State Location-Specific Applicable or Relevant and Appropriate Requirements
Engineering Evaluation/Cost Analysis, Yosemite Slough, San Francisco, California

Location	Requirement	Prerequisite	Citation[a]	Preliminary ARAR Determination[a]	Comments
Hydrologic Resources – Federal Requirements					
Navigable waters	Permits required for structures or work in or affecting navigable waters.	Activities affecting navigable waters	Rivers and Harbors Act of 1899 33 USC § 403, 33 CFR Part 322	Relevant and appropriate	The substantive provisions of this requirement are relevant and appropriate requirements for dredging and capping that may affect navigable waters.
Water Protection – Federal Requirements					
Navigable waters	Action to prohibit discharge of dredged or fill material into waters of the United States without a permit.	Waters of the United States, including a mudflat as described in 40 CFR §230.42	Clean Water Act of 1988, as Amended, Section 404, 33 USC § 1344, 33 CFR § 320.4 and Part 323, 40 CFR §§ 230.10, 230.11, 230.20 - 230.32, and 230.42	Applicable	The substantive provisions are applicable for the discharge of dredged or fill material to a waters of the United States. EPA will notify USFWS of plans and actions taken to comply with these potential ARARs.
Biological Resources – State Requirements					
California Endangered Species Act	Protection of State listed or proposed threatened or endangered species.	Presence of a State listed species	CCR title 14, §§ 670.1, 670.2 and 670.5	Applicable	Prohibits the "taking" of listed and proposed threatened or endangered State species except as otherwise provided in State law.
Habitat for bird nests and eggs	Prohibits the take, possession or needless destruction of the nest or eggs of any bird	Nests and eggs	Cal. Fish and Game Code § 3503	Applicable	The substantive provisions of this requirement are potential ARARs.
Habitat for Nongame birds	Prohibits the take of nongame birds	Nongame birds.	Cal. Fish and Game Code § 3800	Applicable	The substantive provisions of this requirement are potential ARARs.
Nongame mammals	Prohibits the take or possession of nongame mammals.	Nongame mammals	Cal. Fish and Game Code § 4150	Applicable	The substantive provisions of this requirement are potential ARARs.

Table F-2 Potential Federal and State Location-Specific Applicable or Relevant and Appropriate Requirements
Engineering Evaluation/Cost Analysis, Yosemite Slough, San Francisco, California

Location	Requirement	Prerequisite	Citation[a]	Preliminary ARAR Determination[a]	Comments
Habitat for mollusks crustaceans, and invertebrates	Prohibits the take or possession unless expressly permitted, of mollusks, crustaceans, and invertebrates.	Mollusks, crustaceans, and invertebrates	Cal. Fish and Game Code § 8500	Applicable	The substantive provisions of this requirement are potential ARARs.
Coastal Resources – State Requirements					
Within the San Francisco Bay coastal zone	Reduce fill and disposal of dredged material in San Francisco Bay, maintain marshes and mudflats to the fullest extent possible to conserve wildlife, abate pollution, and protect the beneficial uses of the bay.	Activities affecting San Francisco Bay and 100 feet of the shoreline	San Francisco Bay Plan at CCR title 14, §§ 10110 through 11990	Relevant and appropriate	The remedial alternatives will comply to the extent possible with the substantive purposes of the San Francisco Bay Plan.
Tidelands or submerged lands adjacent to San Francisco Bay	Establishes a permit requirement to fill, extract, or to make any substantial change in use of any water, land or structure in or near San Francisco Bay.	Filling or extracting materials in tidelands (land lying between mean high tide and mean low tide) and submerged lands (land lying below mean low tide) in or near San Francisco Bay.	McActeer-Petris Act Cal. Gov. Code title 7.2, § 66632	Applicable	The substantive provisions of this requirement are potential ARARs.

Table F-2 Potential Federal and State Location-Specific Applicable or Relevant and Appropriate Requirements
Engineering Evaluation/Cost Analysis, Yosemite Slough, San Francisco, California

Location	Requirement	Prerequisite	Citation[a]	Preliminary ARAR Determination[a]	Comments
Wetlands Protection – State Requirements					
Waters of the State	Prohibits depositing in, permitting to pass into, or placing where the following can pass into waters of the state: petroleum, acid, coal or oil tar, aniline, asphalt, bitumen, residuary products of petroleum, carbonaceous material or substance, or any substance or material harmful to fish, plant life, mammals or bird life.	Deposit of material harmful to fish, plant, or bird life	Cal. Fish and Game Code § 5650(a)	Relevant and appropriate	The substantive provisions of § 5650(a) are relevant and appropriate

Notes:
[a] Only the substantive provisions of the requirements cited in this table are potential ARARs.

Key:
§ = Section
ARAR = Applicable or relevant and appropriate requirement
Cal. = California
CFR = Code of Federal Regulations
Regs. = Regulations
TBC = to-be-considered
USC = United States Code

Table F-3 Potential Federal and State Action-Specific Applicable or Relevant and Appropriate Requirements
Engineering Evaluation/Cost Analysis, Yosemite Slough, San Francisco, California

Action	Requirement	Prerequisite	Citation[a]	Preliminary ARAR Determination	Comments
Dredging and Excavation					
Federal Requirements					
Resource Conservation and Recovery Act (42 USC, ch. 82, §§ 6901 through 6991[i])[b]					
On-site generation of waste	Person who generates waste shall determine if the waste is a RCRA hazardous waste.	Generator of waste	CCR title 22, §§ 66262.10(a) and 66262.11	Applicable	These regulations are applicable to any operation that generates waste. A determination whether the waste is RCRA hazardous waste will be made at the time it is generated.
On-site generation of waste	Requirements for analyzing waste for determining whether waste is hazardous.	Generator of waste	CCR title 22, § 66264.13(a) and (b)	Applicable	These regulations are applicable to any operation that generates waste. A determination whether the waste is RCRA hazardous waste will be made at the time it is generated.
Stockpiling and dewatering of sediment for off- site disposal	Allows generators to accumulate solid remediation waste in an EPA-designated pile for storage only up to 2 years during response actions without triggering land disposal restrictions.	RCRA hazardous waste temporarily stored in piles	40 CFR § 264.554(a), (d), (g), (h), (i), (j), and (k)	Relevant and appropriate	The response action work will temporarily stockpile debris, sediment and soil for Yosemite Slough in staging piles on land parcels in close proximity to the Site (e.g. property owned by the California State Parks located south of the Site). Stockpiled sediment will be dewatered and treated as described in the EE/CA. EPA has determined that the real property used for these staging piles shall be considered "on-site" as defined by CERCLA and NCP. The EPA does not anticipate that the stockpiled materials will be RCRA hazardous waste; however, the EPA has determined that these requirements are relevant and appropriate for all stockpiled soil, debris and sediment.

Table F-3 Potential Federal and State Action-Specific Applicable or Relevant and Appropriate Requirements

Engineering Evaluation/Cost Analysis, Yosemite Slough, San Francisco, California

Action	Requirement	Prerequisite	Citation[a]	Preliminary ARAR Determination	Comments
Clean Water Act of 1988, as Amended, Section 404 (33 USC § 1344)*					
Discharge of water	Owners and operators of construction activities must be in compliance with discharge standards	Discharge of water	40 CFR Part 122, Subpart C	Relevant and appropriate	The substantive requirement of 40 CFR Part 122 Subpart C will be followed in addressing discharges during the response action and from any land-based stockpiles areas used to support or stage the response action.
Discharge to surface water	Monitor the mass for each pollutant limited in the permit; the volume of effluent discharged from each outfall. Monitor according to test procedures approved under 40 CFR Part 136 for the analyses of pollutants having approved methods	Permit requirements under CWA 301(b)	40 CFR §122.44(i)(1)(iv)	Relevant and appropriate	Substantive provisions are relevant and appropriate for the discharge of dewatering effluent. Specific discharge requirements will be provided in the response action design.
Discharge to surface water	Technology-based treatment requirements for permits	Permit requirements under CWA 301(b)	40 CFR §125.3	Relevant and appropriate	Substantive provisions are relevant and appropriate for the discharge of dewatering effluent. Specific discharge requirements will be provided in the response action design.
Toxic Substances Control Act (15 USC ch. 53, §§ 2601-2692)*					
Storage of PCB remediation waste	Establishes requirements for storage of PCB remediation wastes released into the environment.	Storage of PCBs	40 CFR §§ 761.65(c)(4) and (c)(9)	Relevant and appropriate	Excavated sediment that contains PCBs may be stored on site up to 180 days. The storage area must have a liner, cover, and run-on control system.
Decontamination standards for water containing PCBs	Establishes standards for the disposal of water used for decontamination of equipment used in excavation, storage, and treatment of PCB remediation waste.	Decontamination of water	40 CFR § 761.79(b)(1)	Relevant and appropriate	The decontamination standard for PCBs is less than 3 micrograms per liter (µg/L) for water discharges to a publicly owned treatment works or to navigable waters or less than or equal to 0.5 µg/L PCBs for unrestricted use.

Table F-3 Potential Federal and State Action-Specific Applicable or Relevant and Appropriate Requirements
Engineering Evaluation/Cost Analysis, Yosemite Slough, San Francisco, California

Action	Requirement	Prerequisite	Citation[a]	Preliminary ARAR Determination	Comments
State Requirements					
Stormwater discharge	Establishes the state stormwater permit program and sets forth substantive conditions for construction sites larger than 1 acre	Stormwater discharge	Construction General Permit Order 2009-0009-DWQ adopted pursuant to 40 CFR Part 122, Subpart C; 40 CFR §122.44(s)	Applicable	Construction General Permit Order 2009-0009-DWQ applies to excavation activities that affect at least 1 acre. Pursuant to the substantive permit requirements, best management practices will be taken to prevent construction pollutants from contacting storm water and keep erosion products from moving off site. Substantive permit requirements include the development of a Storm Water Pollution Prevention Plan.
Dredging and Excavation	Requires that dredge and fill activities in navigable water under CWA Section 404 achieves state water quality standards	Mudflat alteration	Clean Water Act Section 401, 33 U.S.C. 1341 – State Water Quality Certification	Applicable	EPA will coordinate with California Regional Water Board to ensure substantive requirements are met during response action.
Creation of visible emissions	Limits visible emissions and particulate emissions	Creation of visible emissions	Bay Area Air Quality Management District (BAAQMD) Regulation 6	Applicable	Applicable to any response action which may discharge air contaminants as defined by this rule.
Creation of Odors	Limits odorous emissions and places maximum concentration limits on certain organic emissions	Creation of Odors	BAAQMD, Regulation 7	Applicable	Applicable to any response action which may odors as defined by this rule and establishes measures to address complaints received about odors.
Transportation of hazardous waste	Prior to transport, establishes for container packaging and labeling in accordance with RCRA and Department of Transportation requirements.	Transportation of hazardous waste	CCR title 22, §§ 66262.30 thru 66262.34	Applicable	Applicable to hazardous wastes that is stored temporarily onsite prior to offsite disposal.
Use and Management of Containers of hazardous waste	Ensures appropriate treatment, storage, and removal of hazardous waste	Treatment, storage, and removal of hazardous waste	22 CCR title 22, §§ 66264.171 thru 66264.178	Relevant and Appropriate	Use of compatible containers, container inspections, provisions for secondary containment, closing containers during transport, and removal of all hazardous material at completion of response action.

Table F-3 Potential Federal and State Action-Specific Applicable or Relevant and Appropriate Requirements
Engineering Evaluation/Cost Analysis, Yosemite Slough, San Francisco, California

Action	Requirement	Prerequisite	Citation[a]	Preliminary ARAR Determination	Comments
Land Disposal Restrictions (LDRs)	Scope, Management and Applications of LDRs	Land disposal of hazardous waste	CCR title 22, §§66268.1 - 66268.5, 66268.30 - 66268.35, and 66268.50	Relevant and Appropriate	If hazardous waste is land disposed within the meaning of the LDRs, the hazardous waste will be managed in accordance with the standards stated in these sections of the regulation.
Dredging and Excavation	Actions taken by or at the direction of public agencies to clean up or abate conditions of pollution or nuisance resulting from unintentional or unauthorized releases of waste or pollutants to the environment are exempt from State Water Resources Control Board (SWRCB) regulation of discharges of solid waste to land under 27 CCR §§ 20005-20090, provided that: 1) wastes, pollutants, or contaminated materials removed from the immediate place of release shall be discharged according to the SWRCB-promulgated sections 20200 - 20230; and 2) remedial actions intended to contain the wastes at the place of release shall implement applicable SWRCB-promulgated provisions of CCR Title 27, Division 2, Solid Wastes, to the extent feasible.	Action taken by or at the direction of a public agency to cleanup release of pollutant which may result in discharges of solid waste to land for treatment, storage or disposal.	CCR title 27, §§ 20090(d) and 20200-20230.	Relevant and appropriate	This is a potential ARAR for the selected response action.

Table F-3 Potential Federal and State Action-Specific Applicable or Relevant and Appropriate Requirements
Engineering Evaluation/Cost Analysis, Yosemite Slough, San Francisco, California

Action	Requirement	Prerequisite	Citation[a]	Preliminary ARAR Determination	Comments
Dredging, Excavation and Backfilling	Interim testing procedures for evaluating dredged material disposed of in San Francisco Bay	Placement of dredge materials in San Francisco Bay	USACE, Public Notice 92-7	Applicable	Reassures that any wetland creation, uplands disposal, or dredging projects complete certain notification and listings.
California Civil Code[a]					
Institutional controls	Provides conditions under which land use restrictions will apply to successive owners of land.	Transfer property from the current Site owner to any subsequent Site owner.	Cal. Civil Code §1471	Relevant and Appropriate	Substantive provisions are the following general narrative standard: "to do or refrain from doing some act on his or her own land... [where] (a)(3) each act relates to the use of land and each act is reasonably necessary to protect present or future human health or safety or the environment as a result of the presence of hazardous materials, as defined in § 25260 of the Cal. Health & Safety Code." This narrative standard would be implemented through incorporation of restrictive covenants in the deed at the time of transfer.
California Health and Safety Code[a]					
Institutional controls	Allows DTSC to enter into an agreement with the owner of a hazardous waste facility to restrict present and future land uses	Hazardous waste permitted facility where restrictive land use is necessary to protect present or future public safety.	Cal. Health and Safety Code § 25202.5	Relevant and Appropriate	The substantive provisions of this section are the general narrative standards to restrict "present and future uses of all or part of the land on which the facility ...is located" to protect present or future public safety.
Institutional controls	Provides a streamlined process to be used to enter into an agreement to restrict specific use of property in order to implement the substantive use restrictions of Cal. Health and Safety Code § 25232(b)(1)(A)–(E)	Property requires restricted use to limit exposure to hazardous wastes.	Cal. Health and Safety Code §§ 25222.1 and 25355.5(a) (1)(C)	Relevant and Appropriate	Cal. Health & Safety Code § 25222.1 provides the authority for the state to enter into voluntary agreements to establish land-use covenants with the owner of the property. The substantive provision of Cal. Health and Safety Code § 25222.1 is the general narrative standard: "restricting specified uses of the property."

Table F-3 Potential Federal and State Action-Specific Applicable or Relevant and Appropriate Requirements
Engineering Evaluation/Cost Analysis, Yosemite Slough, San Francisco, California

Action	Requirement	Prerequisite	Citation[a]	Preliminary ARAR Determination	Comments
Institutional Controls	Provides a process for obtaining a written variance from a land use restriction	Property owner requests variance from existing land use restriction.	Cal. Health and Safety Code §§ 25233(c) and 25234	Relevant and Appropriate	Cal. Health and Safety Code § 25233(c) sets forth substantive criteria for granting variances from the uses prohibited in § 25232(b)(1)(A)-(E) based on specific environmental and health criteria.

Notes:
[a] Only the substantive provisions of the requirements cited in this table are potential ARARs.
[b] Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader. Listing the statutes and policies does not indicate that the EPA has determined that entire statutes or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only substantive requirements of specific citations are considered potential ARARs.

Key:
BAAQMD = Bay Area Air Quality Management District
CCR = *California Code of Regulations*
CFR = *Code of Federal Regulations*
DTSC = Department of Toxic Substances Control
mg/kg = Milligram per kilogram
PCB = Polychlorinated biphenyl
ppm = Part per million
RCRA = Resource Conservation and Recovery Act
USC = *United States Code*

F.3 Abbreviations and Acronyms

§	Section
ARAR	applicable or relevant and appropriate requirement
CCR	California Code of Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
EP	extraction procedure
EPA	United States Environmental Protection Agency
Fed. Reg.	Federal Register
mg/kg	milligram per kilogram
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
PCB	polychlorinated biphenyl
ppm	part per million
RCRA	Resource Conservation and Recovery Act
Res.	Resolution

G Cost Estimates

The cost estimates in this Appendix were developed using unit prices contained in *RS Means Heavy Construction Cost Data* 23rd Annual Edition published in 2012, vendor quotes, and guidance provided in the EPA document entitled *A Guide to Developing and Documenting Cost Estimates during the Feasibility Study* published in 2000(EPA/540/R-00/002). The estimated cost includes an extra 25% for contingencies.

Table G-1 Summary of Total Present Values of Alternatives at Yosemite Slough, San Francisco, CA

	Estimated Total Project Duration	Capital Cost	Annual O&M	Periodic O&M	2013 Total Present Value of Alternative
Alternative 1					
No Action	0	$0	$0	$0	**$0**
Alternative 2					
Mechanical Dredging	30	$10,735,000	$0	$246,000	**$10,981,000**
Hydraulic Dredging	30	$10,100,000	$0	$246,000	**$10,346,000**
Alternative 3					
Mechanical Dredging	30	$9,506,000	$380,000	$246,000	**$10,132,000**
Hydraulic Dredging	30	$9,500,000	$380,000	$246,000	**$10,126,000**
Alternative 4					
Mechanical Dredging	30	$7,960,000	$380,000	$246,000	**$8,586,000**
Hydraulic Dredging	30	$8,180,000	$380,000	$246,000	**$8,806,000**
Alternative 5					
Mechanical Dredging	30	$14,852,000	$380,000	$246,000	**$15,478,000**
Hydraulic Dredging	30	$14,506,000	$380,000	$246,000	**$15,132,000**
Alternative 6					
Mechanical Dredging	30	$28,981,000	$0	$246,000	**$29,227,000**
Hydraulic Dredging	30	$28,230,000	$0	$246,000	**$28,476,000**
Alternative 7					
Mechanical Dredging	1	$43,454,000	$0	$0	**$43,454,000**
Hydraulic Dredging	1	$46,212,000	$0	$0	**$46,212,000**

Table G-2 Cost Estimate for Mechanical Dredging for Alternative 2: Remove sediments in the Top 1 - foot interval where COCs exceed RGs; Engineered Cap and ICs
Yosemite Slough Site, San Francisco, CA

Item Description	Comment	Unit	Quantity	Unit Cost	Cost	Reference
Capital Cost						
Institutional Controls		Each	1	$25,000.00	$25,000	Engineer's estimate
				Subtotal:	**$25,000**	
Preconstruction/Site Preparation						
Surveying Crew	assume availability of the crew during mobilization/demobilization for pre- and post-construction surveys and during excavation/capping.	Day	28	$1,889.31	$52,901	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. Crew A-7
Cut and Chip Trees	Trees to 6" dia.; assume 1 acre for haul roads and one acre for staging areas	Acre	2	$4,625.00	$9,250	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 11 10.10-0020
Grub Stumps and Remove	Trees to 6" dia.; assume 1 acre for haul roads and one acre for staging areas	Acre	2	$2,050.00	$4,100	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 11 10.10-0150
Strip topsoil and Stockpile	200 HP Dozer, adverse conditions; Assume top 6" would be stripped and stockpiled for disposal	CY	1614	$0.98	$1,582	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.31 14 13.23 0020
Crushed Stone for establishing haul roads and staging areas	Assume 6" layer of Crushed Stone, spread with 200 HP Dozer, no compaction, 2 mi. RT haul	CY	1614	$42.00	$67,788	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 05 16.10 0300
Compaction	Riding, Vibrating Roller, 6" Lifts, 2 passes	CY	1614	$0.45	$726	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 23 23.23 5000
Grading	Grading subgrade for base course, roadways.	SY	9680	$0.20	$1,936	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 22 16.10 3300
Install Fence	Chain link industrial, 6' H, 6 gauge wire with 3 strands barb wire; around staging area	LF	3000	$30.00	$90,000	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 32 31 13.20-0500
Gate	Double swing gates, includes posts with 12' opening	Each	2	$1,100.00	$2,200	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.32 31 13.20-5060
Signs	Reflectorized 24"x 24" sign mounted to fence	Each	4	$130.00	$520	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 10 14 53.20-0100; increase by 50% for text customization
Office Trailer Rental	Office trailer, furnished, rent per month, 50' x 12' excl. hookups. + air conditioning. Assume 6 month rental	MO	6	$425.50	$2,553	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 52 13.20 0550
Office Trailer Delivery	Office trailer, delivery and pickup, assume 40 miles/round trip	MI	40	$11.65	$466	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 52 13.20 0800
Trailer Telephone	Field office expense - telephone bill; avg. bill/month, incl. long distance., Assume 6 month rental	MO	6	$89.00	$534	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 52 13.40 0140
Lights and HVAC	Field office expense - field office lights & HVAC., Assume 6 month rental	MO	6	$167.00	$1,002	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 52 13.40 0160
Sanitary Facilities	Rent toilet, portable, chemical, Assume 6 month rental	MO	6	$183.00	$1,098	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 54 33.40 6410 (Construciton Aids)
Three Phase power supply	Assume cost for setting up electrical service to operate equipment to be around $20,000	LS	1	$20,000.00	$20,000	Engineer's Estimate
Utility Cost during Project activities	Assume $15,000	LS	1	$15,000.00	$15,000	Engineer's Estimate
Bank Treatment Debris Removal	Cost for removing debris located along the Slough banks. Assume 1 Gradall, 3 ton, 1 CY, 1 Equipment Operator, 4 laborers	Day	5	$3,448.20	$17,241	2013 RSMeans Site Work and Landscape Cost Data Crew B-12 K + 3 laborers
Bank Treatment Transport Debris to Staging Area	Assume 50 truck loads of debris will be removed from banks. 8 C.Y. truck, 15 MPH ave, cycle 1 mile, 30 min wait/Ld./ Uld.	CY	400	$7.55	$3,020	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.. 31 23 23.20-0414
Transportation of Collected Debris	Debris removed for staging area/access road construction and other Debris. Dump truck transport from Yosemite Slough to Landfill; incl taxes and fees	Ton	3,021	$50.00	$151,050	Engineer's Estimate
Disposal of Collected Debris	Debris removed for staging area/access road construction and other Debris. Disposal at Landfill; incl taxes and fees	Ton	3,021	$50.00	$151,050	Engineer's Estimate
Bank Treatment Backfill	Assume 1-1/2" crushed stone will be used to fill in depressions that could potentially could form during excavation activities. Assume 500 CY of fill, includes cost for spreading, 2 mi RT Haul	LCY	500	$42.00	$21,000	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 05 16.10 0300
Erosion and Sediment Controls - Jute Mesh	Includes Jute Mesh 100 SY per roll, 4' wide, stapled	SY	9,680	$2.06	$19,941	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 25 14.16 0020
Erosion and Sediment Control - Silt Fence & Hay Bales	Includes Silt Fence, polypropylene, 3' high, adverse conditions & Hay Bales, staked	LF	3,000	$11.75	$35,250	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 25 14.16 1100 + 1250
				Subtotal:	**$670,300**	
Health and Safety						
Health and Safety Plan	Prepare Site-specific health and safety plan as well as prepare community notification documents	Each	1	$10,000.00	$10,000	Engineer's Estimate
Construct Decontamination Pad & Containment	For equipment and personnel, Assume 4 setups will be needed.	Setups	4	$5,000.00	$20,000	Engineer's Estimate
Water Supply for Decontamination	Assume daily water need for decontamination process is 5,000 gallons/setup.	100 CF	1,016	$5.10	$5,182	2012 costs from the San Francisco Public Utilities Commission. Water price of $5.10 per 100 CF.
Community/Exclusion Zone Air Monitoring	Air Quality equipment (Qty 4)	Each	4	$7,200.00	$28,800	Engineer's Estimate
Site Safety Officer	10 hrs./day, 5days/wk., $100/hr; 100% of project duration	manweeks	8	$5,000.00	$40,000	Engineer's Estimate
				Subtotal:	**$104,000**	
Construction Mob/Demob						
Construction Oversight	10 hrs./day, 5days/wk., $100/hr.; 100% of project duration	manweeks	8	$5,000.00	$40,000	Engineer's Estimate
Pre-Construction Safety Meeting	Pre-Construction safety meeting for all equipment operators and other personnel on the job. Assume 20 people will attend for 8 hours at $125/hour	Each	20	$1,000.00	$20,000	Engineer's Estimate
Mobilization for Dry Excavation Equipment	Up to 25 mile haul distance; 3 loader, 1 forklift, 2 excav., 1 grader, 1 paver, and 2 Trucks above 150 H.P.,	Each	10	$505.00	$5,050	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 54 36.50-0100
Demobilization for Dry Excavation Equipment	Up to 25 mile haul distance; 3 loader, 1 forklift, 2 excav., 1 grader, 1 paver, and 2 Trucks above 150 H.P.,	Each	10	$505.00	$5,050	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 54 36.50-0100
				Subtotal:	**$70,100**	
Hydraulic/Turbidity Controls						
Hydraulic/Turbidity Controls	Assume uniform $1,000,000 placeholder for all alternatives	LS	1	$1,000,000	$1,000,000	Engineer's Estimate
				Subtotal:	**$1,000,000**	
Contaminated Sediment Removal (Sediment Excavation, Transport, and Stockpiling)						
Timber Crane Mats for Slough Access	Cost for timber mat material. Assume the Yosemite Slough width is 300 ft., the number of pieces of Mat needed to cross the Slough is: 300 ft./4ft =75. Assume 200 mats needed for the entire project.	Each	200	$785.00	$157,000	The Mat Source: http://www.thematsource.com/mat-inventory/timber-mats.html. Douglas Fir Crane Mats (12 in *4 ft. * 20 ft.), each mat consists of 4 timbers. Accessed in June 2012.

Table G-2 Cost Estimate for Mechanical Dredging for Alternative 2: Remove sediments in the Top 1 - foot interval where COCs exceed RGs; Engineered Cap and ICs
Yosemite Slough Site, San Francisco, CA

Item Description	Comment	Unit	Quantity	Unit Cost	Cost	Reference
Timber Crane Mats Relocation	Backhoe Loader, 80 HP, 1 equipment operator and 2 laborers. For adjusting and relocating timber mats as needed during the project duration	Day	38	$1,888.04	$71,746	2013 RSMeans Site Work and Landscape Cost Data Crew B-11 M plus one additional laborer
Excavation of Sediment	Excavator, hydraulic, 2 CY bucket = 165 CY/hr. Assume 5 % of the volume removed would be debris.	BCY	5,515	$45.00	$248,175	Engineer's Estimate
Loading sediment onto trucks	add 15%	BCY	5,515	$6.75	$37,226	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 23 16.42-0020
Add long reach boom/arm for excavator	add 50% of the excavator costs	BCY	5,515	$22.50	$124,088	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 23 16.42-4250
Transport Sediment to Stockpile (staging area)	8 C.Y. truck, 15 MPH ave, cycle 1 mile, 30 min wait/Ld./ Uld.	LCY	6,342	$7.55	$47,884	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 23 23.20-0414
Stockpiling of Dredged Sediment	1 F.E. Loaders, Wheel Mounted, 2.5 CY capacity, 1 operator and laborer, available onsite full time during excavation, capping, restoration and demobilization activities.	Day	28	$1,371.22	$38,394	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. Crew B-10T
Sediment Dewatering	Including debris removal, generator, shakers, belt press, and polymer dosage. Assumed Dewatering for mechanical and hydraulic dredging activities are equal.	LCY	6,342	$63.00	$399,562	2012 Vendor quote provided by JND Thomas Co., Inc. provided for Hydraulic dredging.
				Subtotal	**$1,124,100**	
Sediment Stabilization for Lead						
Sediment Stabilization	EnviroBlend CS, 1-3% wt./wt. dosage, 2000 # Supersacks, material only	Ton	45	$285.00	$12,825	2012 Vendor Quote from Premier Chemicals LLC.
Transportation Costs	Freight Costs, $1,300/22 sacks	Ton	45	$59.09	$2,659	2012 Vendor Quote from Premier Chemicals LLC.
ForkLift Rental	Assume Forklift rental for one day when the material would be delivered onsite	Day	1	$1,117.24	$1,117	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. Crew A-3P
Mixing Sediment with the product	Front End Loader, 5 CY bucket	LCY	1,150	$1.94	$2,231	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 312316.42-1350
Characterization Sampling of Treated Sediment	Assume 1 sample required per 100 LCY. Includes TCLP, STLC, TTLC testsmetals and PCBs	Each	12	$1,000.00	$12,000	Engineer's Estimate
				Subtotal:	**$30,900**	
Transportation and Disposal of Non-hazardous sediment						
Characterization Sampling of Dewatered Sediment	Assume 1 sample required per 500 LCY. Includes analysis for metals and PCBs	Each	13	$1,000.00	$13,000	Engineer's Estimate
Loading Sediment onto Trucks	Front End Loader, 5 CY bucket, Assumed Loading will occur during the excavation and capping activites.	Day	18	$1,954.00	$35,172	2012 RSMeans Site Work and Landscape Cost Data 31st Ed. Crew B-10U
Transportation	Dump truck transport from Yosemite Slough to Landfill; incl taxes and fees	Ton	8,273	$50.00	$413,625	Engineer's Estimate
Disposal	Disposal at Landfill; incl taxes and fees	Ton	8,273	$50.00	$413,625	Engineer's Estimate
				Subtotal:	**$875,500**	
Treatment of Dewatering Process Water						
FRAC Tank Rental; for "holding tank" of water	6 x 21,000 Tank with Cleaning	Day	38	$1,200.00	$45,600	Engineer's Estimate
Rain for Rent dewatering process water treatment system mobilization	process involves a settling tank, sand filtration, bag filter, carbon filter, resins/Organoclay, holding tank for testing	Each	1	$75,000.00	$75,000	Oakley Rain for Rent Quote from Tony DeBellis (2012)
Rain for Rent dewatering process water treatment system spent media disposal and replacement	cost is 125% of cost for mobilization for each media replacement	Each	1	$93,750.00	$93,750	Oakley Rain for Rent Quote from Tony DeBellis (2012)
Treament System Operations	One operator	Day	38	$574.00	$21,812	2013 RSMeans Site Work and Landscape Cost Data One Equip. Oper. (med)
Characterization/Monitoring Sampling of Dewatering Process Water	Including pH, TDS, TSS, COD, Metals, PCBs. Assume one sample is needed every 10000 CF of processed water.	Each	42	$1,000.00	$42,000	Engineer's Estimate
				Subtotal:	**$278,200**	
Discharge of Dewatering Process Water to SFPUC						
Permit Fee		Each	1	$1,000.00	$1,000	Engineer's Estimate
Batch Discharge to SFPUC	Sewer service charge is per 100 cubic feet discharged	100 CF	4,158	$6.56	$27,276	2012 costs from the San Franciso Public Utilities Commission. Water price of $6.55 per 100 CF.
				Subtotal:	**$28,300**	
Capping						
Capping Material Transportation	Assume the amount of material needed is equal to the amount sediment removed. Assume material is 1.5 ton/CY based on data from the Geotechnical Study	Ton	8,273	$50.00	$413,625	Engineer's Estimate. Source of material has not been identified at this time.
Excavator for Installation of Cap material	Excavator, hydraulic, 2 CY bucket	LCY	6,342	$40.00	$253,690	Engineer's Estimate.
Add long reach boom/arm for excavator	add 50% of the excavator costs	LCY	6,342	$20.00	$126,845	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 23 16.42-4250
				Subtotal:	**$794,200**	
Post Construction Costs						
Site Restoration for Staging Area/Access Roads	grading of access roads and staging area for paving	Day	2	$1,102.66	$2,205	2013 RSMeans Site Work and Landscape Cost Data Crew B-10L - 0.5 laborer
Site Restoration for Access road/staging area	Plant-mix Asphalt Paving with binder course 2.5" thick.	SY	9680	$11.30	$109,384	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 32 12 16.13-0130
Site Restoration for Staging Area	Plant-mix Asphalt Paving with wearing course 2.5" thick.	SY	9680	$12.55	$121,484	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 32 12 16.13-0420
Project Closeout	Phase II Investigation costs	Each	1	$25,000.00	$25,000	Engineer's Estimate
				Subtotal:	**$258,100**	
				Capital Costs Subtotal:	$5,258,700	
				Adjusted Capital Cost Subtotal for San Francisco, CA Location Factor (123.4):	$6,489,300	
				10% Legal and Administrative Fees:	$649,000	
				20% Contingencies:	$1,297,900	
				Predesign Investigations	$1,000,000	Engineer's Estimate
				Construction Management (10% of total capital cost)	$649,000	Engineer's Estimate
				Engineering Design (10 % of total capital cost)	$649,000	Engineer's Estimate
				Total Capital Costs in 2013 Dollars:	**$10,735,000**	
Annual Costs						
				Annual Cost Subtotal:	$0	
				Adjusted Capital Cost Subtotal for San Francisco, CA Location Factor (123.4):	$0	
				10% Legal and Administrative Fees	$0	
				20% Contingencies:	$0	
				Annual Total:	$0	
				30-Year Present Worth of Annual Monitoring Costs:	**$0**	

Table G-2 Cost Estimate for Mechanical Dredging for Alternative 2: Remove sediments in the Top 1 - foot interval where COCs exceed RGs; Engineered Cap and ICs
Yosemite Slough Site, San Francisco, CA

Item Description	Comment	Unit	Quantity	Unit Cost	Cost	Reference
Periodic (5-year) Monitoring for 30 years						
Institutional Controls	Easement, fencing, signs	LS	1	$25,000	$25,000	Engineer's Estimate
Site Monitoring		LS	1	$20,000	$20,000	Engineer's Estimate
Reporting		LS	1	$10,000	$10,000	Engineer's Estimate
				5-Year Cost Subtotal:	$55,000	
	Adjusted Capital Cost Subtotal for San Francisco, CA Location Factor (123.4):				$67,870	
				10% Legal and Administrative Fees:	$6,787	
				20% Contingencies:	$13,574	
				5-Year Total:	$88,231	
				30-Year Present Worth of Periodic Costs:	**$246,000**	
				2013 Present Worth Cost:	**$10,981,000**	

Assumptions

1. Volume of Contaminated Material (Total)	5,515 BCY, as estimated using the polygon method, E&E, 2013	
2. Volume of Hazardous lead contaminated soil	1,000 BCY	
3. Perimeter around staging area	3000 ft	
4. Area available for Staging Area	13 acre	
5. Project Duration		
Mobilization	5 days	
Dewatering and Treatment system set up	5 days	
Excavation	9 days	Total volume removed/excavation rate of 165 CY/HR. Assume 8 hours per day, 5 days per week, Assume 50% production rate.
Capping	9 days	
Restoration	5 days	
Demobilization	5 days	
Total Project Duration	38 days	
6. Dewatering		
Volume of water from the sediment (assume that the sediment will only have 30% water, as dewatering activities would have removed most of the water)	44671.5 CF	
Volume of water that would be pumped during dewatering (assume 50 gpm, 24 hours a day during dewatering setup, excavation, capping and restoration)	269,519 CF	
7. In-Situ Bulk Density assumed for the project is	1.5 Tons/BCY	
8. Swell Factor was assumed to be	15%	

9. Assume access road preparation will disturb 1 acre and the staging area will disturb 1 acre for a total of 2 acres.
10. After construction activities are completed, the disturbed two acres will require pavement restoration.
11. The surveying crew will be needed for the entire project duration to compete a pre-excavation, post-excavation, and post capping surveys and to assist the excavation crew.
12. The cofferdam needed is 1000' (length) by 36' (depth). Assume that a silt curtain will be in place during the installation and removal of the cofferdam.
13. Assume 5000 gallons of water/decon setup would be needed daily for decontamination purposes. Assume this water will be treated by the dewatering process water treatment facility.
14. Approximately 200 timber crane mats will be needed for the entire project to account for breakups, losses etc.
15. One sample is needed every 10,000 CF of processed water.
16. The Suspended Solids, Oil/Grease and COD will be removed during the sediment dewatering process.
17. Assume that there is a manhole located onsite discharge of treated dewatering process water.
18. Assume there is a fire hydrant onsite for the supply of decontamination water.
19. Onsite material from access road creation will be used to fill in depressions created by debris removal.
20. Amount of backfill material needed for bank treatment is 1000' bank length x 50' width x 2' depth.
21. Assume 50 truck loads of debris will be removed from banks.
22. Present worth of costs assumes 5% annual interest rate.
23. Unit costs listed were obtained from 2012 RS Means Cost Data and engineering judgement.
24. Institutional Controls at the site are expected to include deed restrictions, informational signs and dissemination of information by the State Parks to the general public.

Key:
LF = Linear Foot
SY = Square Yard
BCY = Bank Cubic Yard
LCY = Loose Cubic Yard
LS = Lump Sum
SF = Square Feet
CF = Cubic Feet

Table G-3 Cost Estimate for Hydraulic Dredging for Alternative 2: Remove sediments in the Top 1 - foot interval where COCs exceed RGs; Engineered Cap and ICs
Yosemite Slough Site, San Francisco, CA

Item Description	Comment	Unit	Quantity	Unit Cost	Cost	Reference
Capital Cost						
Institutional Controls		Each	1	$25,000.00	$25,000	Engineer's estimate
				Subtotal:	**$25,000**	
Preconstruction/Site Preparation						
Site Preparation, access road construction, site survey, mobilization and demobilization of equipment	Includes construction of 8" HDPE pipe for sediment transport to staging area, and launching of the dredge, See assumptions below for additional details on what is included in the mobilization costs	LS	1	$400,000.00	$400,000	2012 Vendor Quote from JND Thomas Co, Inc.
Install Fence	Chain link industrial, 6' H, 6 gauge wire with 3 strands barb wire; around staging area	LF	3000	$30.00	$90,000	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 32 31 13.20-0500
Gate	Double swing gates, includes posts with 12' opening	Each	2	$1,100.00	$2,200	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 32 31 13.20-5060
Signs	Reflectorized 24"x 24" sign mounted to fence	Each	4	$130.00	$520	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 10 14 53.20-0100; increase by 50% for text customization
Office Trailer Rental	Office trailer, furnished, rent per month, 50' x 12' excl. hookups. + air conditioning. Assume 6 month rental	MO	6	$425.50	$2,553	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 52 13.20 0550
Office Trailer Delivery	Office trailer, delivery and pickup, assume 40 miles/round trip	MI	40	$11.65	$466	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 52 13.20 0800
Trailer Telephone	Field office expense - telephone bill; avg. bill/month, incl. long distance., Assume 6 month rental	MO	6	$89.00	$534	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.. 01 52 13.40 0140
Lights and HVAC	Field office expense - field office lights & HVAC., Assume 6 month rental	MO	6	$167.00	$1,002	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 52 13.40 0160
Sanitary Facilities	Rent toilet, portable, chemical, Assume 6 month rental	MO	6	$183.00	$1,098	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 54 33.40 6410 (Construciton Aids)
Three Phase power supply	Assume cost for setting up electrical service to operate equipment to be around $20,000	LS	1	$20,000.00	$20,000	Engineer's Estimate
Utility Cost during Project activities	Assume $15,000	LS	1	$15,000.00	$15,000	Engineer's Estimate
Bank Treatment Debris Removal	Cost for removing debris located along the Slough banks. Assume 1 Gradall, 3 ton, 1 CY, 1 Equipment Operator, 4 laborers	Day	5	$3,448.20	$17,241	2013 RSMeans Site Work and Landscape Cost Data Crew B-12 K + 3 laborers
Bank Treatment Transport Debris to Staging Area	Assume 50 truck loads of debris will be removed from banks. 8 C.Y. truck, 15 MPH ave, cycle 1 mile, 30 min wait/Ld./ Uld.	LCY	400	$7.55	$3,020	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 23 23.20-0414
Transportation of Collected Debris	Debris removed for staging area/access road construction and other Debris. Dump truck transport from Yosemite Slough to Landfill; incl taxes and fees	Ton	600	$50.00	$30,000	Engineer's Estimate
Disposal of Collected Debris	Debris removed for staging area/access road construction and other Debris. Disposal at Landfill; incl taxes and fees	Ton	600	$50.00	$30,000	Engineer's Estimate
Bank Treatment Backfill	Assume 1-1/2" crushed stone will be used to fill in depressions that could potentially could form during excavation activities. Assume 500 CY of fill, includes cost for spreading, 2 mi RT Haul	LCY	500	$42.00	$21,000	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.31 05 16.10 0300
Erosion and Sediment Controls - Jute Mesh	Includes Jute Mesh 100 SY per roll, 4' wide, stapled, 2 acres	SY	9,680	$2.06	$19,941	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 25 14.16 0020
Erosion and Sediment Control - Silt Fence & Hay Bales	Includes Silt Fence, polypropylene, 3' high, adverse conditions & Hay Bales, staked	LF	3,000	$11.75	$35,250	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 25 14.16 1100 + 1250
				Subtotal:	**$689,825**	
Health and Safety						
Health and Safety Plan	Prepare Site-specific health and safety plan as well as prepare community notification documents	Each	1	$10,000.00	$10,000	Engineer's Estimate
Construct Decontamination Pad & Containment	For equipment and personnel, Assume 4 setups will be needed.	Setups	4	$5,000.00	$20,000	Engineer's Estimate
Water Supply for Decontamination phases	Assume daily water need for decontamination process is 5,000 gallons/setup.	100 CF	1,551	$5.10	$7,909	2012 costs from the San Franciso Public Utilities Commission. Water price of $5.10 per 100 CF.
Community/Exclusion Zone Air Monitoring	Air Quality equipment (Qty 4)	Each	4	$7,200.00	$28,800	Engineer's Estimate
Site Safety Officer	10 hrs/day, 5days/wk, $100/hr; 100% of project duration	manweeks	12	$5,000.00	$58,000	Engineer's Estimate
				Subtotal:	**$124,800**	
Construction Costs						
Construction Oversight	10 hrs/day, 5days/wk, $100/hr; 100% of project duration	manweeks	12	$5,000.00	$58,000	Engineer's Estimate
Pre-Construction Safety Meeting	Pre-Construction safety meeting for all equipment operators and other personnel on the job. Assume 20 people will attend for 8 hours at $125/hour	Each	20	$1,000.00	$20,000	Engineer's Estimate
				Subtotal:	**$78,000**	
Hydraulic/Turbidity Controls						
Hydraulic/Turbidity Controls	Assume uniform $1,000,000 placeholder for all alternatives	LS	1	$1,000,000	$1,000,000	Engineer's Estimate
				Subtotal:	**$1,000,000**	
Contaminated Sediment Removal (Hydraulic Dredging)						
Sediment removal and pumping to sediment dewatering plant at site access area through an 8" HDPE pipeline	using the Moray 8" Swinging Ladder Dredge	BCY	5,515	$63.00	$347,445	2012 Vendor Quote from JND Thomas Co, Inc.
Cofferdam Construction and Removal	Based on supply and installation of cofferdam	LS	1	$410,000.00	$410,000	2012 Vendor Quote from JND Thomas Co, Inc.
				Subtotal:	**$757,500**	
Sediment Dewatering and Characterization						
Dewatering System and Dewatered Sediment Stockpiling	The dewatering system is expected to include Two Dual Tandem Shakers, Two Mix tanks, 4 14" Hydro-cyclones, Hydro-clear HC2500 Clarifier, Three belt presses, polymer dosage and additional storage tank prior to disposal to the slough. Flow is expected to be around 2000 gpm. Includes costs for Characterization and monitoring costs	LCY	6,342	$63.00	$399,562	2012 Vendor Quote from JND Thomas Co, Inc.
				Subtotal:	**$399,600**	

Table G-3 Cost Estimate for Hydraulic Dredging for Alternative 2: Remove sediments in the Top 1 - foot interval where COCs exceed RGs; Engineered Cap and ICs
Yosemite Slough Site, San Francisco, CA

Item Description	Comment	Unit	Quantity	Unit Cost	Cost	Reference
Sediment Stabilization for Lead						
Sediment Stabilization	EnviroBlend CS, 1-3% wt./wt. dosage, 2000 # Supersacks, material only	Ton	45	$285.00	$12,825	2012 Vendor Quote from Premier Chemicals LLC.
Transportation Costs	Freight Costs, $1,300/22 sacks	Ton	45	$59.09	$2,659	2012 Vendor Quote from Premier Chemicals LLC.
ForkLift Rental	Assume Forklift rental for one day when the material would be delivered onsite	Day	1	$1,117.24	$1,117	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. Crew A-3P
Mixing Sediment with the product	Front End Loader, 5 CY bucket	LCY	1,150	$1.94	$2,231	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.312316.42-1350
Characterization Sampling of Treated Sediment	Assume 1 sample required per 100 LCY. Includes TCLP, STLC, TTLC testsmetals and PCBs	Each	12	$1,000.00	$12,000	Engineer's Estimate
				Subtotal:	**$30,900**	
Transportation and Disposal of Non-hazardous sediment						
Characterization Sampling of Dewatered Sediment	Assume 1 sample required per 500 LCY. Includes analysis for total metals and PCBs	Each	13	$1,000.00	$13,000	Engineer's Estimate
Loading Sediment onto Trucks	Front End Loader, 5 CY bucket, Assumed Loading will occur during the excavation and capping activites.	Day	38	$1,942.57	$73,818	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. Crew B-10T. Add 5 labors.
Transportation	Dump truck transport from Yosemite Slough to Landfill; incl taxes and fees	Ton	9,513	$50.00	$475,669	Engineer's Estimate
Disposal	Disposal at Landfill; incl taxes and fees	Ton	9,513	$50.00	$475,669	Engineer's Estimate
				Subtotal:	**$1,038,200**	
Treatment of Decontamination Process Water						
FRAC Tank Rental; for "holding tank" of water	4 x 21,000 Tank with Cleaning	Day	58	$800.00	$46,400	Engineer's Estimate
Rain for Rent dewatering process water treatment system mobilization	process involves a settling tank, sand filtration, bag filter, carbon filter, resins/Organoclay, holding tank for testing	Each	1	$75,000.00	$75,000	Oakley Rain for Rent Quote from Tony DeBellis (2012)
Rain for Rent dewatering process water treatment system spent media disposal and replacement	cost is 125% of cost for mobilization for each medial replacement	Each	1	$93,750.00	$93,750	Oakley Rain for Rent Quote from Tony DeBellis (2012)
Treament System Operations	One operator	Day	58	$574.00	$33,292	2013 RSMeans Site Work and Landscape Cost Data One Equip. Oper. (med)
Characterization/Monitoring Sampling of Dewatering Process Water	Including pH, TDS, TSS, COD, Total Metals, PCBs. Assume one sample is needed every 10000 CF of processed water.	Each	33	$1,000.00	$33,000	Engineer's Estimate
				Subtotal:	**$281,500**	
Discharge of Decontamination Process Water to SFPUC						
Permit Fee		Each	1	$1,000.00	$1,000	Engineer's Estimate
Batch Discharge to SFPUC	Sewer service charge is per 100 cubic feet discharged. Only for Water from the decon activities	CF	2,751	$6.56	$18,045	2013 costs from the San Franciso Public Utilities Commission. Water price of $6.55 per 100 CF.
				Subtotal:	**$19,100**	
Capping						
Capping Material Transportation	Assume the amount of material needed is equal to the amount sediment removed. Assume material is 1.5 ton/CY based on data from the Geotechnical Study	Ton	57	$50.00	$2,850	Engineer's Estimate. Source of material has not been identified at this time.
Excavator for Installation of Cap material	Excavator, hydraulic, 2 CY bucket	LCY	6,342	$40.00	$253,690	Engineer's Estimate.
Add long reach boom/arm for excavator	add 50% of the excavator costs	LCY	6,342	$20.00	$126,845	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 23 16.42-4250
				Subtotal	**$383,400**	
Post Construction Costs						
Site Restoration for Access Roads	grading of access roads	Day	2	$1,266.02	$2,532	2013 RSMeans Site Work and Landscape Cost Data Crew B-10L - 0.5 laborer
Site Restoration for Staging Area	Plant-mix Asphalt Paving with wearing course 2.5" thick. Assume 1 acre will be disturbed	SY	4840	$12.55	$60,742	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 12 16.13-0420
Project Closeout	Phase II Investigation costs	Each	1	$25,000.00	$25,000	Engineer's Estimate
				Subtotal	**$88,300**	
Capital Costs Subtotal:					$4,916,125	
Adjusted Capital Cost Subtotal for San Francisco, CA Location Factor (123.4):					$6,066,500	
10% Legal and Administrative Fees					$606,700	
20% Contingencies:					$1,213,300	
Predesign Investigations					$1,000,000	Engineer's Estimate
Construction Management (10% of total capital cost)					$606,700	Engineer's Estimate
Engineering Design 10 % of total capital cost					$606,700	Engineer's Estimate
Total Capital Costs in 2013 Dollars:					**$10,100,000**	
Annual Costs						
Annual Cost Subtotal:					$0	
Adjusted Capital Cost Subtotal for San Francisco, CA Location Factor (123.4):					$0	
10% Legal and Administrative Fees					$0	
20% Contingencies:					$0	
Annual Total:					$0	
30-Year Present Worth of Annual Monitoring Costs:					**$0**	
Periodic (5-year) Monitoring for 30 years						
Institutional Controls	Easement, fencing, signs	LS	1	$25,000	$25,000	Engineer's Estimate
Site Monitoring		LS	1	$20,000	$20,000	Engineer's Estimate
Reporting		LS	1	$10,000	$10,000	Engineer's Estimate
5-Year Cost Subtotal:					$55,000	
Adjusted Capital Cost Subtotal for San Francisco, CA Location Factor (123.4):					$67,870	
10% Legal and Administrative Fees					$6,787	
20% Contingencies:					$13,574	
5-Year Total:					$88,231	
30-Year Present Worth of 5-Year Costs:					**$246,000**	
2013 Present Worth Cost:					**$10,346,000**	

Table G-3 Cost Estimate for Hydraulic Dredging for Alternative 2: Remove sediments in the Top 1 - foot interval where COCs exceed RGs; Engineered Cap and ICs
Yosemite Slough Site, San Francisco, CA

Item Description	Comment	Unit	Quantity	Unit Cost	Cost	Reference
Assumptions						
1. Volume of Contaminated Material	5,515	BCY, as estimated using the polygon method, E&E, 2013				
2. Volume of Hazardous lead contaminated soil	1,000	BCY				
3. Perimeter around staging area	3000	ft				
4. Area available for Staging Area	13	acre				
5. Project Duration						
Mobilization	5	days				
Dewatering and Treatment system set up	5	days				
Dredging	19	days	Dredging rate is 300 CY/day. Assume 5 days per week			
Capping	19	days				
Restoration	5	days				
Demobilization	5	days				
Total Project Duration	58	days				
6. Volume of water generated from staging area activities (the dewatering water treatment costs have been included in the vendor cost for dewatering activities)	120,000	CF				
7. In-Situ Bulk Density assumed for the project is	1.5	Tons/BCY				
8. Swell Factor was assumed to be	15%					

9. Assume access road preparation will disturb 1 acre and the staging area will disturb 1 acre for a total of 2 acres.
10. After construction activities are completed, the disturbed two acres will require pavement restoration.
11. The surveying crew will be needed for the entire project duration to compete a pre-excavation, post-excavation, and post capping surveys and to assist the excavation crew.
12. Two cofferdams will be installed to contain the flow during the hydraulic dredging activities. Assume that a silt curtain will be installed as part of this process.
13. Assume 5000 gallons of water/setup would be needed daily for decontamination purposes. Assume this water will be treated by the dewatering process water treatment facility.
14. One sample is needed every 10,000 CF of processed water.
15. The Suspended Solids, Oil/Grease and COD will be removed during the sediment dewatering process.
16. Assume that there is a manhole located onsite discharge of treated dewatering process water.
17. Assume there is a fire hydrant onsite for the supply of decontamination water.
18. Onsite material from access road creation will be used to fill in depressions created by debris removal.
19. Amount of backfill material needed for bank treatment is 1000' bank length x 50' width x 2' depth.
20. Assume 50 truck loads of debris will be removed from banks.
21. Present worth of costs assumes 5% annual interest rate.
22. Unit costs listed were obtained from 2012 RS Means Cost Data and engineering judgement.
23. Mobilization costs provided by the vendor includes three phases of mobilization. Phase I includes obtaining permits, constructing access roads, site prep, erosion/stormwater control fencing, safety signs etc and Turbidity curtains. All other measures such as monitoring processes and traffic regulations necessary will be put in place. Phase II will involve the installation of dewatering equipment and the launching of dredges as well as installation of dredge pipes. Phase III will include testing of equipment, surveying, work layout and staking of the pond. Set up of water and power will also be
24. Institutional Controls at the site are expected to include deed restrictions, informational signs and dissemination of information by the State Parks to the general public.

Key:
LF = Linear Foot
SY = Square Yard
BCY = Bank Cubic Yard
LCY = Loose Cubic Yard
LS = Lump Sum
SF = Square Feet
CF = Cubic Feet

Table G-4 Cost Estimate for Mechanical Dredging for Alternative 3: Top 1 - foot removal where COCs exceed 2xRGs, Engineered Cap, MNR and ICs
Yosemite Slough Site, San Francisco, CA

Item Description	Comment	Unit	Quantity	Unit Cost	Cost	Reference
Capital Cost						
Institutional Controls		Each	1	$25,000.00	$25,000	Engineer's estimate
				Subtotal	**$25,000**	
Preconstruction/Site Preparation						
Surveying Crew	assume availability of the crew during mobilization/demobilization for pre- and post-construction surveys and during excavation/capping.	Day	24	$1,889.31	$45,343	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. Crew A-7
Cut and Chip Trees	Trees to 6" dia.; assume 1 acre for haul roads and one acre for staging areas	Acre	2	$4,625.00	$9,250	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 11 10.10-0020
Grub Stumps and Remove	Trees to 6" dia.; assume 1 acre for haul roads and one acre for staging areas	Acre	2	$2,050.00	$4,100	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 11 10.10-0150
Strip topsoil and Stockpile	200 HP Dozer, adverse conditions; Assume top 6" would be stripped and stockpiled for disposal	CY	1614	$0.98	$1,582	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 14 13.23 0020
Crushed Stone for establishing haul roads and staging areas	Assume 6" layer of Crushed Stone, spread with 200 HP Dozer, no compaction, 2 mi. RT haul	CY	1614	$42.00	$67,788	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 05 16.10 0300
Compaction	Riding, Vibrating Roller, 6" Lifts, 2 passes	CY	1614	$0.45	$726	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.31 23 23.23 5000
Grading	Grading subgrade for base course, roadways.	SY	9680	$0.20	$1,936	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.31 22 16.10 3300
Install Fence	Chain link industrial, 6' H, 6 gauge wire with 3 strands barb wire; around staging area	LF	3000	$30.00	$90,000	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 32 31 13.20-0500
Gate	Double swing gates, includes posts with 12' opening	Each	2	$1,100.00	$2,200	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 32 31 13.20-5060
Signs	Reflectorized 24"x 24" sign mounted to fence	Each	4	$130.00	$520	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 10 14 53.20-0100; increase by 50% for text customization
Office Trailer Rental	Office trailer, furnished, rent per month, 50' x 12' excl. hookups. + air conditioning. Assume 6 month rental	MO	6	$425.50	$2,553	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 52 13.20 0550
Office Trailer Delivery	Office trailer, delivery and pickup, assume 40 miles/round trip	MI	40	$11.65	$466	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 52 13.20 0800
Trailer Telephone	Field office expense - telephone bill; avg. bill/month, incl. long distance., Assume 6 month rental	MO	6	$89.00	$534	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 52 13.40 0140
Lights and HVAC	Field office expense - field office lights & HVAC., Assume 6 month rental	MO	6	$167.00	$1,002	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.01 52 13.40 0160
Sanitary Facilities	Rent toilet, portable, chemical	MO	6	$183.00	$1,098	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 54 33.40 6410 (Construciton Aids)
Three Phase power supply	Assume cost for setting up electrical service to operate equipment to be around $20,000	LS	1	$20,000.00	$20,000	Engineer's Estimate
Utility Cost during Project activities	Assume $15,000	LS	1	$15,000.00	$15,000	Engineer's Estimate
Bank Treatment Debris Removal	Cost for removing debris located along the Slough banks. Assume 1 Gradall, 3 ton, 1 CY, 1 Equipment Operator, 4 laborers	Day	5	$3,448.20	$17,241	2013 RSMeans Site Work and Landscape Cost Data Crew B-12 K + 3 laborers
Bank Treatment Transport Debris to Staging Area	Assume 50 truck loads of debris will be removed from banks. 8 C.Y. truck, 15 MPH ave, cycle 1 mile, 30 min wait/Ld./ Uld.	LCY	400	$7.55	$3,020	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 23 23.20-0414
Transportation of Collected Debris	Debris removed for staging area/access road construction and other Debris. Dump truck transport from Yosemite Slough to Landfill; incl taxes and fees	Ton	3,021	$50.00	$151,050	Engineer's Estimate
Disposal of Collected Debris	Debris removed for staging area/access road construction and other Debris. Disposal at Landfill; incl taxes and fees	Ton	3,021	$50.00	$151,050	Engineer's Estimate
Bank Treatment Backfill	Assume 1-1/2" crushed stone will be used to fill in depressions that could potentially could form during excavation activities. Assume 500 CY of fill, includes cost for spreading, 2 mi RT Haul	LCY	500	$42.00	$21,000	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.31 05 16.10 0300
Erosion and Sediment Controls - Jute Mesh	Includes Jute Mesh 100 SY per roll, 4' wide, stapled	SY	9,680	$2.06	$19,941	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 25 14.16 0020
Erosion and Sediment Control - Silt Fence & Hay Bales	Includes Silt Fence, polypropylene, 3' high, adverse conditions & Hay Bales, staked	LF	3,000	$11.75	$35,250	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 25 14.16 1100 + 1250
				Subtotal	**$662,700**	
Health and Safety						
Health and Safety Plan	Prepare Site-specific health and safety plan as well as prepare community notification documents	Each	1	$10,000.00	$10,000	Engineer's Estimate
Construct Decontamination Pad & Containment	For equipment and personnel, Assume 4 setups will be needed.	Setups	4	$5,000.00	$20,000	Engineer's Estimate
Water Supply for Decontamination	Assume daily water need for decontamination process is 5,000 gallons/setup.	100 CF	909	$5.10	$4,636	2012 costs from the San Francisco Public Utilities Commission. Water price of $5.10 per 100 CF.
Community/Exclusion Zone Air Monitoring	Particulate meter purchase (Qty 4)	Each	4	$7,200.00	$28,800	Industrial Environmental Monitoring Instruments, http://www.ierents.com/ as of January 2012
Site Safety Officer	10 hrs./day, 5days/wk., $100/hr.; 100% of project duration	manweeks	7	$5,000.00	$35,000	Engineer's Estimate
				Subtotal	**$98,500**	
Construction Mob/Demob						
Construction Oversight	10 hrs./day, 5days/wk., $100/hr.; 100% of project duration	manweeks	7	$5,000.00	$35,000	Engineer's Estimate
Pre-Construction Safety Meeting	Pre-Construction safety meeting for all equipment operators and other personnel on the job. Assume 20 people will attend for 8 hours at $125/hour	Each	20	$1,000.00	$20,000	Engineer's Estimate
Mobilization for Dry Excavation Equipment	Up to 25 mile haul distance; 3 loader, 1 forklift, 2 excav., 1 grader, 1 paver, and 2 Trucks above 150 H.P.,	Each	10	$505.00	$5,050	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 54 36.50-0100
Demobilization for Dry Excavation Equipment	Up to 25 mile haul distance; 3 loader, 1 forklift, 2 excav., 1 grader, 1 paver, and 2 Trucks above 150 H.P.,	Each	10	$505.00	$5,050	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 54 36.50-0100
				Subtotal	**$65,100**	
Hydraulic/Turbidity Controls						
Hydraulic/Turbidity Controls	Assume uniform $1,000,000 placeholder for all alternatives	LS	1	$1,000,000	$1,000,000	Engineer's Estimate
				Subtotal	**$1,000,000**	

Table G-4 Cost Estimate for Mechanical Dredging for Alternative 3: Top 1 - foot removal where COCs exceed 2xRGs, Engineered Cap, MNR and ICs
Yosemite Slough Site, San Francisco, CA

Item Description	Comment	Unit	Quantity	Unit Cost	Cost	Reference
Contaminated Sediment Removal (Sediment Excavation, Transport, and Stockpiling)						
Timber Crane Mats for Slough Access	Cost for timber mat material. Assume the Yosemite Slough width is 300 ft., the number of pieces of Mat needed to cross the Slough is: 300 ft./4ft =75. Assume 200 mats needed for the entire project.	Each	200	$785.00	$157,000	The Mat Source: http://www.thematsource.com/mat-inventory/timber-mats.html. Douglas Fir Crane Mats (12 in *4 ft. * 20 ft.), each mat consists of 4 timbers. Accessed in June 2012.
Timber Crane Mats Relocation	Backhoe Loader, 80 HP, 1 equipment operator and 2 laborers. For adjusting and relocating timber mats as needed during the project duration	Day	19	$1,888.04	$35,873	2013 RSMeans Site Work and Landscape Cost Data Crew B-11 M plus one additional laborer
Excavation of Sediment	Excavator, hydraulic, 2 CY bucket = 165 CY/hr.	BCY	4,231	$45.00	$190,395	Engineer's Estimate
Loading sediment onto trucks	add 15% to excavation costs	BCY	4,231	$6.75	$28,559	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 23 16.42-0020
Add long reach boom/arm for excavator	add 50% of the excavator costs	BCY	4,231	$22.50	$95,198	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 23 16.42-4250
Transport Sediment to Stockpile (staging area)	8 C.Y. truck, 15 MPH ave, cycle 1 mile, 30 min wait/Ld./ Uld.	LCY	4,866	$7.55	$36,736	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.31 23 23.20-0414
Stockpiling of Dredged Sediment	1 F.E. Loaders, Wheel Mounted, 2.5 CY capacity, 1 operator and laborer, available onsite full time during excavation, capping, restoration and demobilization activities.	Day	24	$1,371.22	$32,909	2013 RSMeans Site Work and Landscape Cost Data 31st Ed. Crew B-10T
Sediment Dewatering	including debris removal, generator, shakers, belt press, and polymer dosage. Assumed Dewatering for mechanical and hydraulic dredging activities are equal.	LCY	4,866	$63.00	$306,536	2012 Vendor quote provided by JND Thomas Co., Inc. provided for Hydraulic dredging.
				Subtotal	**$883,300**	
Sediment Stabilization for Lead						
Sediment Stabilization	EnviroBlend CS, 1-3% wt./wt. dosage, 2000 # Supersacks, material only	Ton	45	$285.00	$12,825	2012 Vendor Quote from Premier Chemicals LLC.
Transportation Costs	Freight Costs, $1,300/22 sacks	Ton	45	$59.09	$2,659	2012 Vendor Quote from Premier Chemicals LLC.
ForkLift Rental	Assume Forklift rental for one day when the material would be delivered onsite	Day	1	$1,117.24	$1,117	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. Crew A-3P
Mixing Sediment with the product	Front End Loader, 5 CY bucket	LCY	1,150	$1.94	$2,231	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.312316.42-1350
Characterization Sampling of Treated Sediment	Assume 1 sample required per 100 LCY. Includes TCLP, STLC, TTLC testsmetals and PCBs	Each	12	$1,000.00	$12,000	Engineer's Estimate
				Subtotal	**$30,900**	
Transportation and Disposal of Non-hazardous sediment						
Characterization Sampling of Dewatered Sediment	Assume 1 sample required per 500 LCY. Includes analysis for metals and PCBs	Each	10	$1,000.00	$10,000	Engineer's Estimate
Loading Sediment onto Trucks	Front End Loader, 5 CY bucket, Assumed Loading will occur during the excavation and capping activites.	Day	14	$1,954.00	$27,356	2012 RSMeans Site Work and Landscape Cost Data 31st Ed. Crew B-10U
Transportation	Dump truck transport from Yosemite Slough to Landfill; incl taxes and fees	Ton	6,347	$50.00	$317,325	Engineer's Estimate
Disposal	Disposal at Landfill; incl taxes and fees	Ton	6,347	$50.00	$317,325	Engineer's Estimate
				Subtotal	**$672,100**	
Treatment of Dewatering Process Water						
FRAC Tank Rental; for "holding tank" of water	6 x 21,000 Tank with Cleaning	Day	34	$1,200.00	$40,800	Engineer's Estimate
Rain for Rent dewatering process water treatment system mobilization	process involves a settling tank, sand filtration, bag filter, carbon filter, resins/Organoclay, holding tank for testing	Each	1	$75,000.00	$75,000	Oakley Rain for Rent Quote from Tony DeBellis (2012)
Rain for Rent dewatering process water treatment system spent media disposal and replacement	cost is 125% of cost for mobilization for each media replacement	Each	1	$93,750.00	$93,750	Oakley Rain for Rent Quote from Tony DeBellis (2012)
Treament System Operations	One operator	Day	34	$574.00	$19,516	2013 RSMeans Site Work and Landscape Cost Data One Equip. Oper. (med)
Characterization/Monitoring Sampling of Dewatering Process Water	Including pH, TDS, TSS, COD, Metals, PCBs. Assume one sample is needed every 10000 CF of processed water.	Each	36	$1,000.00	$36,000	Engineer's Estimate
				Subtotal	**$265,100**	
Discharge of Dewatering Process Water to SFPUC						
Permit Fee		Each	1	$1,000.00	$1,000	Engineer's Estimate
Batch Discharge to SFPUC	Sewer service charge is per 100 cubic feet discharged	100 CF	3,562	$6.56	$23,366	2012 costs from the San Franciso Public Utilities Commission. Water price of $6.55 per 100 CF.
				Subtotal	**$24,400**	
Capping						
Capping Material Transportation	Assume the amount of material needed is equal to the amount sediment removed. Assume material is 1.5 ton/CY based on data from the Geotechnical Study	Ton	6,347	$50.00	$317,325	Engineer's Estimate. Source of material has not been identified at this time.
Excavator for Installation of Cap material	Excavator, hydraulic, 2 CY bucket	LCY	4,866	$40.00	$194,626	Engineer's Estimate.
Add long reach boom/arm for excavator	add 50% of the excavator costs	LCY	4,866	$20.00	$97,313	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 23 16.42-4250
				Subtotal	**$609,300**	
Post Construction Costs						
Site Restoration for Staging Area/Access Roads	grading of access roads and staging area for paving	Day	2	$1,266.02	$2,532	2013 RSMeans Site Work and Landscape Cost Data Crew B-10L - 0.5 laborer
Site Restoration for Access road/staging area	Plant-mix Asphalt Paving with binder course 2.5" thick.	SY	9680	$11.30	$109,384	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 32 12 16.13-0130
Site Restoration for Staging Area	Plant-mix Asphalt Paving with wearing course 2.5" thick.	SY	9680	$12.55	$121,484	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 32 12 16.13-0420
Project Closeout	Phase II Investigation costs	Each	1	$25,000.00	$25,000	Engineer's Estimate
				Subtotal	**$258,500**	
				Capital Costs Subtotal:	$4,594,900	
				Adjusted Capital Cost Subtotal for San Francisco, CA Location Factor (123.4):	$5,670,200	
				10% Legal and Administrative Fees	$567,100	
				20% Contingencies:	$1,134,100	
				Predesign Investigations	$1,000,000	Engineer's Estimate
				Construction Management (10% of total capital cost)	$567,100	Engineer's Estimate
				Engineering Design (10 % of total capital cost)	$567,100	Engineer's Estimate
				Total Capital Costs in 2013 Dollars:	**$9,506,000**	
Monitored Natural Attenuation						
MNR Costs		LS	1	$236,840.00	$236,840	MNR costs provided by Arcadis (2012)
				Annual Cost Subtotal:	$236,840	
				Adjusted Capital Cost Subtotal for San Francisco, CA Location Factor (123.4):	$292,261	
				10% Legal and Administrative Fees	$29,226	
				20% Contingencies:	$58,452	
				Total:	**$380,000**	

Table G-4 Cost Estimate for Mechanical Dredging for Alternative 3: Top 1 - foot removal where COCs exceed 2xRGs, Engineered Cap, MNR and ICs
Yosemite Slough Site, San Francisco, CA

Item Description	Comment	Unit	Quantity	Unit Cost	Cost	Reference
Periodic (5-year) Monitoring for 30 years						
Institutional Controls	Easement, fencing, signs	LS	1	$25,000	$25,000	Engineer's Estimate
Site Monitoring		LS	1	$20,000	$20,000	Engineer's Estimate
Reporting		LS	1	$10,000	$10,000	Engineer's Estimate
				5-Year Cost Subtotal:	$55,000	
				Adjusted Capital Cost Subtotal for San Francisco, CA Location Factor (123.4):	$67,870	
				10% Legal and Administrative Fees	$6,787	
				20% Contingencies:	$13,574	
				5-Year Total:	$88,231	
				30-Year Present Worth of Periodic Monitoring Costs:	**$246,000**	
				2013 Present Worth Cost:	**$10,132,000**	

Assumptions

1. Volume of Contaminated Material (Total) 4,231 BCY, as estimated using the polygon method, E&E, 2013
2. Volume of Hazardous lead contaminated soil 1,000 BCY
3. Perimeter around staging area 3000 ft
4. Area available for Staging Area 13 acre
5. Project Duration
   - Mobilization 5 days
   - Dewatering and Treatment system set up 5 days
   - Excavation 7 days
   - Capping 7 days
   - Restoration 5 days
   - Demobilization 5 days
   - Total Project Duration 34 days

   Total volume removed/excavation rate of 165 CY/HR. Assume 8 hours per day, 5 days per week, Assume 50% production rate.
6. Dewatering
   - Volume of water from the sediment (assume that the sediment will only have 30% water, as dewatering activities would have removed most of the water) 34271.1 CF
   - Volume of water that would be pumped during dewatering (assume 50 gpm, 24 hours a day during dewatering setup, excavation, capping and restoration) 231,016 CF
7. In-Situ Bulk Density assumed for the project is 1.5 Tons/BCY
8. Swell Factor was assumed to be 15%
9. Assume access road preparation will disturb 1 acre and the staging area will disturb 1 acre for a total of 2 acres.
10. After construction activities are completed, the disturbed two acres will require pavement restoration.
11. The surveying crew will be needed for the entire project duration to compete a pre-excavation, post-excavation, and post capping surveys and to assist the excavation crew.
12. The cofferdam needed is 1000' (length) by 36' (depth). Assume that a silt curtain will be in place during the installation and removal of the cofferdam.
13. Assume 5000 gallons of water/decon setup would be needed daily for decontamination purposes. Assume this water will be treated by the dewatering process water treatment facility.
14. Approximately 200 timber crane mats will be needed for the entire project.
15. One sample is needed every 10,000 CF of processed water.
16. The Suspended Solids, Oil/Grease and COD will be removed during the sediment dewatering process.
17. Assume that there is a manhole located onsite discharge of treated dewatering process water.
18. Assume there is a fire hydrant onsite for the supply of decontamination water.
19. Onsite material from access road creation will be used to fill in depressions created by debris removal.
20. Amount of backfill material needed for bank treatment is 1000' bank length x 50' width x 2' depth.
21. Assume 10 truck loads of debris will be removed from banks.
22. Present worth of costs assumes 5% annual interest rate.
23. Unit costs listed were obtained from 2012 RS Means Cost Data and engineering judgement.
24. Institutional Controls at the site are expected to include deed restrictions, informational signs and dissemination of information by the State Parks to the general public.

Key:
LF = Linear Foot
SY = Square Yard
BCY = Bank Cubic Yard
LCY = Loose Cubic Yard
LS = Lump Sum
SF = Square Feet
CF = Cubic Feet

Table G-5 Cost Estimate for Hydraulic Dredging for Alternative 3: Top 1 - foot removal where COCs exceed 2xRGs, Engineered Cap, MNR and ICs
Yosemite Slough Site, San Francisco, CA

Item Description	Comment	Unit	Quantity	Unit Cost	Cost	Reference
Capital Cost						
Institutional Controls		Each	1	$25,000.00	$25,000	Engineer's estimate
				Subtotal:	**$25,000**	
Preconstruction/Site Preparation						
Site Preparation, access road construction, site survey, mobilization and demobilization of equipment	Includes construction of 8" HDPE pipe for sediment transport to staging area, and launching of the dredge, See assumptions below for additional details on what is included in the mobilization costs	LS	1	$400,000.00	$400,000	Quote from JND Thomas Co, Inc.
Install Fence	Chain link industrial, 6' H, 6 gauge wire with 3 strands barb wire; around staging area	LF	3000	$30.00	$90,000	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 32 31 13.20-0500
Gate	Double swing gates, includes posts with 12' opening	Each	2	$1,100.00	$2,200	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 32 31 13.20-5060
Signs	Reflectorized 24"x 24" sign mounted to fence	Each	4	$130.00	$520	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.10 14 53.20-0100; increase by 50% for text customization
Office Trailer Rental	Office trailer, furnished, rent per month, 50' x 12' excl. hookups. + air conditioning. Assume 6 month rental	MO	6	$425.50	$2,553	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 52 13.20 0550
Office Trailer Delivery	Office trailer, delivery and pickup, assume 40 miles/round trip	MI	40	$11.65	$466	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 52 13.20 0800
Trailer Telephone	Field office expense - telephone bill; avg. bill/month, incl. long distance., Assume 6 month rental	MO	6	$89.00	$534	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 52 13.40 0140
Lights and HVAC	Field office expense - field office lights & HVAC., Assume 6 month rental	MO	6	$167.00	$1,002	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.01 52 13.40 0160
Sanitary Facilities	Rent toilet, portable, chemical, Assume 6 month rental	MO	6	$183.00	$1,098	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 54 33.40 6410 (Construciton Aids)
Three Phase power supply	Assume cost for setting up electrical service to operate equipment to be around $20,000	LS	1	$20,000.00	$20,000	Engineer's Estimate
Utility Cost during Project activities	Assume $15,000	LS	1	$15,000.00	$15,000	Engineer's Estimate
Bank Treatment Debris Removal	Cost for removing debris located along the Slough banks. Assume 1 Gradall, 3 ton, 1 CY, 1 Equipment Operator, 4 laborers	Day	5	$3,448.20	$17,241	2013 RSMeans Site Work and Landscape Cost Data Crew B-12 K + 3 laborers
Bank Treatment Transport Debris to Staging Area	Assume 50 truck loads of debris will be removed from banks. 8 C.Y. truck, 15 MPH ave, cycle 1 mile, 30 min wait/Ld./ Uld.	LCY	400	$7.55	$3,020	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 23 23.20-0414
Transportation of Collected Debris	Debris removed for staging area/access road construction and other Debris. Dump truck transport from Yosemite Slough to Landfill; incl taxes and fees	Ton	600	$50.00	$30,000	Engineer's Estimate
Disposal of Collected Debris	Debris removed for staging area/access road construction and other Debris. Disposal at Landfill; incl taxes and fees	Ton	600	$50.00	$30,000	Engineer's Estimate
Bank Treatment Backfill	Assume 1-1/2" crushed stone will be used to fill in depressions that could potentially could form during excavation activities. Assume 500 CY of fill, includes cost for spreading, 2 mi RT Haul	LCY	500	$42.00	$21,000	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 05 16.10 0300
Erosion and Sediment Controls - Jute Mesh	Includes Jute Mesh 100 SY per roll, 4' wide, stapled, 2 acres	SY	9,680	$2.06	$19,941	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 25 14.16 0020
Erosion and Sediment Control - Silt Fence & Hay Bales	Includes Silt Fence, polypropylene, 3' high, adverse conditions & Hay Bales, staked	LF	3,000	$11.75	$35,250	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 25 14.16 1100 + 1250
				Subtotal:	**$689,825**	
Health and Safety						
Health and Safety Plan	Prepare Site-specific health and safety plan as well as prepare community notification documents	Each	1	$10,000.00	$10,000	Engineer's Estimate
Construct Decontamination Pad & Containment	For equipment and personnel, Assume 4 setups will be needed.	Setups	4	$5,000.00	$20,000	Engineer's Estimate
Water Supply for Decontamination phases	Assume daily water need for decontamination process is 5,000 gallons/setup.	CF	1,337	$5.10	$6,818	2012 costs from the San Francisco Public Utilities Commission. Water price of $5.10 per 100 CF.
Community/Exclusion Zone Air Monitoring	Particulate meter purchase (Qty 4)	Each	4	$7,200.00	$28,800	Industrial Environmental Monitoring Instruments, http://www.ierents.com/ as of January 2012
Site Safety Officer	10 hrs/day, 5days/wk, $100/hr; 100% of project duration	manweeks	10	$5,000.00	$50,000	Engineer's Estimate
				Subtotal:	**$115,700**	
Hydraulic/Turbidity Controls						
Hydraulic/Turbidity Controls	Assume uniform $1,000,000 placeholder for all alternatives	LS	1	$1,000,000	$1,000,000	Engineer's Estimate
				Subtotal:	**$1,000,000**	
Construction Costs						
Construction Oversight	10 hrs/day, 5days/wk, $100/hr; 100% of project duration	manweeks	10	$5,000.00	$50,000	Engineer's Estimate
Pre-Construction Safety Meeting	Pre-Construction safety meeting for all equipment operators and other personnel on the job. Assume 20 people will attend for 8 hours at $125/hour	Each	20	$1,000.00	$20,000	Engineer's Estimate
				Subtotal:	**$70,000**	
Contaminated Sediment Removal (Hydraulic Dredging)						
Sediment removal and pumping to sediment dewatering plant at site access area through an 8" HDPE pipeline	using the Moray 8" Swinging Ladder Dredge	BCY	4,231	$63.00	$266,553	Vendor quote from JND Thomas Co., Inc.
Cofferdam Construction and Removal	Based on supply and installation of cofferdam	LS	1	$410,000.00	$410,000	Vendor quote from JND Thomas Co., Inc.
				Subtotal:	**$676,600**	
Sediment Dewatering and Characterization						
Dewatering System and Dewatered Sediment Stockpiling	The dewatering system is expected to include Two Dual Tandem Shakers, Two Mix tanks, 4 14" Hydro-cyclones, Hydro-clear HC2500 Clarifier, Three belt presses, polymer dosage and additional storage tank prior to disposal to the slough. Flow is expected to be around 2000 gpm. Includes costs for Characterization and monitoring costs	LCY	4,866	$63.00	$306,536	Vendor quote from JND Thomas Co., Inc.
				Subtotal:	**$306,600**	

Table G-5 Cost Estimate for Hydraulic Dredging for Alternative 3: Top 1 - foot removal where COCs exceed 2xRGs, Engineered Cap, MNR and ICs
Yosemite Slough Site, San Francisco, CA

Item Description	Comment	Unit	Quantity	Unit Cost	Cost	Reference
Sediment Stabilization for Lead						
Sediment Stabilization	EnviroBlend CS, 1-3% wt./wt. dosage, 2000 # Supersacks, material only	Ton	45	$285.00	$12,825	2012 Vendor Quote from Premier Chemicals LLC.
Transportation Costs	Freight Costs, $1,300/22 sacks	Ton	45	$59.09	$2,659	2012 Vendor Quote from Premier Chemicals LLC.
ForkLift Rental	Assume Forklift rental for one day when the material would be delivered onsite	Day	1	$1,117.24	$1,117	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. Crew A-3P
Mixing Sediment with the product	Front End Loader, 5 CY bucket	LCY	1,150	$1.94	$2,231	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 312316.42-1350
Characterization Sampling of Treated Sediment	Assume 1 sample required per 100 LCY. Includes TCLP, STLC, TTLC testsmetals and PCBs	Each	12	$1,000.00	$12,000	Engineer's Estimate
				Subtotal:	**$30,900**	
Transportation and Disposal of Non-hazardous sediment						
Characterization Sampling of Dewatered Sediment	Assume 1 sample required per 500 LCY. Includes analysis for total metals and PCBs, TCLP, hexavelent chromium, paint filter test	Each	10	$1,000.00	$10,000	Engineer's Estimate
Loading Sediment onto Trucks	Front End Loader, 5 CY bucket, Assumed Loading will occur during the excavation and capping activites.	Day	30	$1,954.00	$58,620	2012 RSMeans Site Work and Landscape Cost Data 31st Ed. Crew B-10U
Transportation	Dump truck transport from Yosemite Slough to Landfill; incl taxes and fees	Ton	6,347	$50.00	$317,325	Engineer's Estimate
Disposal	Disposal at Landfill; incl taxes and fees	Ton	6,347	$50.00	$317,325	Engineer's Estimate
				Subtotal:	**$703,300**	
Treatment of Decontamination Process Water						
FRAC Tank Rental; for "holding tank" of water	4 x 21,000 Tank with Cleaning	Day	50	$800.00	$40,000	Engineer's Estimate
Rain for Rent dewatering process water treatment system mobilization	process involves a settling tank, sand filtration, bag filter, carbon filter, resins/Organoclay, holding tank for testing	Each	1	$75,000.00	$75,000	Oakley Rain for Rent Quote from Tony DeBellis (2012)
Rain for Rent dewatering process water treatment system spent media disposal and replacement	cost is 125% of cost for mobilization for each medial replacement	Each	1	$93,750.00	$93,750	Oakley Rain for Rent Quote from Tony DeBellis (2012)
Treament System Operations	One operator	Day	50	$574.00	$28,700	2013 RSMeans Site Work and Landscape Cost Data One Equip. Oper. (med)
Characterization/Monitoring Sampling of Dewatering Process Water	Including pH, TDS, TSS, COD, Total Metals, PCBs. Assume one sample is needed every 10000 CF of processed water.	Each	23	$1,000.00	$23,000	Engineer's Estimate
				Subtotal:	**$260,500**	
Discharge of Dewatering Process Water to SFPUC						
Permit Fee		Each	1	$1,000.00	$1,000	Engineer's Estimate
Batch Discharge to SFPUC	Sewer service charge is per 100 cubic feet discharged. Only for Water from the decon activities	CF	2,257	$6.56	$14,805	2012 costs from the San Franciso Public Utilities Commission. Water price of $6.55 per 100 CF.
				Subtotal:	**$15,900**	
Capping						
Capping Material Transportation	Assume the amount of material needed is equal to the amount sediment removed. Assume material is 1.5 ton/CY based on data from the Geotechnical Study	Ton	6,347	$50.00	$317,325	Engineer's Estimate. Source of material has not been identified at this time.
Excavator for Installation of Cap material	Excavator, hydraulic, 2 CY bucket	LCY	4,866	$40.00	$194,626	Engineer's Estimate.
Add long reach boom/arm for excavator	add 50% of the excavator costs	LCY	4,866	$20.00	$97,313	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 23 16.42-4250
				Subtotal	**$609,300**	
Post Construction Costs						
Site Restoration for Access Roads	grading of access roads	Day	2	$1,266.02	$2,532	2013 RSMeans Site Work and Landscape Cost Data Crew B-10L - 0.5 laborer = 1264.64- 216
Site Restoration for Staging Area	Plant-mix Asphalt Paving with wearing course 2.5" thick. Assume 1 acre will be disturbed	SY	4840	$12.55	$60,742	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 12 16.13-0420
Project Closeout	Phase II Investigation costs	Each	1	$25,000.00	$25,000	Engineer's Estimate
				Subtotal	**$88,300**	
				Capital Costs Subtotal:	$4,591,925	
				Adjusted Capital Cost Subtotal for San Francisco, CA Location Factor (123.4):	$5,666,500	
				10% Legal and Administrative Fees	$566,700	
				20% Contingencies:	$1,133,300	
				Predesign Investigations	$1,000,000	Engineer's Estimate
				Construction Management (10% of total capital cost)	$566,700	Engineer's Estimate
				Engineering Design 10 % of total capital cost	$566,700	Engineer's Estimate
				Total Capital Costs in 2013 Dollars:	**$9,500,000**	
Monitored Natural Attenuation						
MNR Costs		LS	1	$236,840.00	$236,840	MNR costs provided by Arcadis (2012)
				Annual Cost Subtotal:	$236,840	
				Adjusted Capital Cost Subtotal for San Francisco, CA Location Factor (123.4):	$292,261	
				10% Legal and Administrative Fees	$29,226	
				20% Contingencies:	$58,452	
				Total:	**$380,000**	

Table G-5 Cost Estimate for Hydraulic Dredging for Alternative 3: Top 1 - foot removal where COCs exceed 2xRGs, Engineered Cap, MNR and ICs
Yosemite Slough Site, San Francisco, CA

Item Description	Comment	Unit	Quantity	Unit Cost	Cost	Reference
Periodic (5-year) Monitoring for 30 years						
Institutional Controls	Easement, fencing, signs	LS	1	$25,000	$25,000	Engineer's Estimate
Site Monitoring		LS	1	$20,000	$20,000	Engineer's Estimate
Reporting		LS	1	$10,000	$10,000	Engineer's Estimate
				5-Year Cost Subtotal:	$55,000	
	Adjusted Capital Cost Subtotal for San Francisco, CA Location Factor (123.4):				$67,870	
				10% Legal and Administrative Fees	$6,787	
				20% Contingencies:	$13,574	
				5-Year Total:	$88,231	
				30-Year Present Worth of 5-Year Costs:	**$246,000**	
				2013 Present Worth Cost:	**$10,126,000**	

Assumptions

1. Volume of Contaminated Material 4,231 BCY, as estimated using the polygon method, E&E, 2013
2. Volume of Hazardous lead contaminated soil 1,000 BCY
3. Perimeter around staging area 3000 ft
4. Area available for Staging Area 13 acre
5. Project Duration
   - Mobilization 5 days
   - Dewatering and Treatment system set up 5 days
   - Dredging 15 days — Dredging rate is 300 CY/day. Assume 5 days per week
   - Capping 15 days
   - Restoration 5 days
   - Demobilization 5 days
   - Total Project Duration 50 days
6. Volume of water generated from staging area activities (the dewatering water treatment costs have been included in the vendor cost for dewatering activities) 92,000 CF
7. In-Situ Bulk Density assumed for the project is 1.5 Tons/BCY
8. Swell Factor was assumed to be 15%
9. Assume access road preparation will disturb 1 acre and the staging area will disturb 1 acre for a total of 2 acres.
10. After construction activities are completed, the disturbed two acres will require pavement restoration.
11. The surveying crew will be needed for the entire project duration to compete a pre-excavation, post-excavation, and post capping surveys and to assist the excavation crew.
12. Two cofferdams will be installed to contain the flow during the hydraulic dredging activities. Assume that a silt curtain will be installed as part of this process.
13. Assume 10,000 gallons of water would be needed daily for decontamination purposes. Assume this water will be treated by the dewatering process water treatment facility.
14. One sample is needed every 10,000 CF of processed water.
15. The Suspended Solids, Oil/Grease and COD will be removed during the sediment dewatering process.
16. Assume that there is a manhole located onsite discharge of treated dewatering process water.
17. Assume there is a fire hydrant onsite for the supply of decontamination water.
18. Onsite material from access road creation will be used to fill in depressions created by debris removal.
19. Amount of backfill material needed for bank treatment is 1000' bank length x 50' width x 2' depth.
20. Assume 50 truck loads of debris will be removed from banks.
21. Present worth of costs assumes 5% annual interest rate.
22. Unit costs listed were obtained from 2012 RS Means Cost Data and engineering judgement.
23. Mobilization costs provided by the vendor includes three phases of mobilization. Phase I includes obtaining permits, constructing access roads, site prep, erosion/stormwater control fencing, safety signs etc and Turbidity curtains. All other measures such as monitoring processes and traffic regulations necessary will be put in place. Phase II will involve the installation of dewatering equipment and the launching of dredges as well as installation of dredge pipes. Phase III will include testing of equipment, surveying, work layout and staking of the pond. Set up of water and power will also be
24. Institutional Controls at the site are expected to include deed restrictions, informational signs and dissemination of information by the State Parks to the general public.

Key:
LF = Linear Foot
SY = Square Yard
BCY = Bank Cubic Yard
LCY = Loose Cubic Yard
LS = Lump Sum
SF = Square Feet
CF = Cubic Feet

Table G-6 Cost Estimate for Mechanical Dredging for Alternative 4: Top 1 - foot removal where COCs exceed 3x RGs (with 2 exceptions), Engineered Cap, MNR and ICs
Yosemite Slough Site, San Francisco, CA

Item Description	Comment	Unit	Quantity	Unit Cost	Cost	Reference
Capital Cost						
Institutional Controls		Each	1	$25,000.00	$25,000	Engineer's estimate
				Subtotal	**$25,000**	
Preconstruction/Site Preparation						
Surveying Crew	assume availability of the crew during mobilization/demobilization for pre- and post-construction surveys and during excavation/capping.	Day	18	$1,889.31	$34,008	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. Crew A-7
Cut and Chip Trees	Trees to 6" dia.; assume 1 acre for haul roads and one acre for staging areas	Acre	2	$4,625.00	$9,250	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 11 10.10-0020
Grub Stumps and Remove	Trees to 6" dia.; assume 1 acre for haul roads and one acre for staging areas	Acre	2	$2,050.00	$4,100	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 11 10.10-0150
Strip topsoil and Stockpile	200 HP Dozer, adverse conditions; Assume top 6" would be stripped and stockpiled for disposal	CY	1614	$0.98	$1,582	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 14 13.23 0020
Crushed Stone for establishing haul roads and staging areas	Assume 6" layer of Crushed Stone, spread with 200 HP Dozer, no compaction, 2 mi. RT haul	CY	1614	$42.00	$67,788	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.31 05 16.10 0300
Compaction	Riding, Vibrating Roller, 6" Lifts, 2 passes	CY	1614	$0.45	$726	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 23 23.23 5000
Grading	Grading subgrade for base course, roadways.	SY	9680	$0.20	$1,936	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 22 16.10 3300
Install Fence	Chain link industrial, 6' H, 6 gauge wire with 3 strands barb wire; around staging area	LF	3000	$30.00	$90,000	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 32 31 13.20-0500
Gate	Double swing gates, includes posts with 12' opening	Each	2	$1,100.00	$2,200	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.32 31 13.20-5060
Signs	Reflectorized 24"x 24" sign mounted to fence	Each	4	$130.00	$520	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 10 14 53.20-0100; increase by 50% for text customization
Office Trailer Rental	Office trailer, furnished, rent per month, 50' x 12' excl. hookups. + air conditioning. Assume 6 month rental	MO	6	$425.50	$2,553	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.01 52 13.20 0550
Office Trailer Delivery	Office trailer, delivery and pickup, assume 40 miles/round trip	MI	40	$11.65	$466	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 52 13.20 0800
Trailer Telephone	Field office expense - telephone bill; avg. bill/month, incl. long distance., Assume 6 month rental	MO	6	$89.00	$534	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 52 13.40 0140
Lights and HVAC	Field office expense - field office lights & HVAC., Assume 6 month rental	MO	6	$167.00	$1,002	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 52 13.40 0160
Sanitary Facilities	Rent toilet, portable, chemical, Assume 6 month rental	MO	6	$183.00	$1,098	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 54 33.40 6410 (Construciton Aids)
Three Phase power supply	Assume cost for setting up electrical service to operate equipment to be around $20,000	LS	1	$20,000.00	$20,000	Engineer's Estimate
Utility Cost during Project activities	Assume $15,000	LS	1	$15,000.00	$15,000	Engineer's Estimate
Bank Treatment Debris Removal	Cost for removing debris located along the Slough banks. Assume 1 Gradall, 3 ton, 1 CY, 1 Equipment Operator, 4 laborers	Day	5	$3,448.20	$17,241	2013 RSMeans Site Work and Landscape Cost Data Crew B-12 K + 3 laborers
Bank Treatment Transport Debris to Staging Area	Assume 50 truck loads of debris will be removed from banks. 8 C.Y. truck, 15 MPH ave, cycle 1 mile, 30 min wait/Ld./ Uld.	CY	400	$7.55	$3,020	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 23 23.20-0414
Transportation of Collected Debris	Debris removed for staging area/access road construction and other Debris. Dump truck transport from Yosemite Slough to Landfill; incl taxes and fees	Ton	3,021	$50.00	$151,050	Engineer's Estimate
Disposal of Collected Debris	Debris removed for staging area/access road construction and other Debris. Disposal at Landfill; incl taxes and fees	Ton	3,021	$50.00	$151,050	Engineer's Estimate
Bank Treatment Backfill	Assume 1-1/2" crushed stone will be used to fill in depressions that could potentially could form during excavation activities. Assume 500 CY of fill, includes cost for spreading, 2 mi RT Haul	LCY	500	$42.00	$21,000	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 05 16.10 0300
Erosion and Sediment Controls - Jute Mesh	Includes Jute Mesh 100 SY per roll, 4' wide, stapled	SY	9,680	$2.06	$19,941	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 25 14.16 0020
Erosion and Sediment Control - Silt Fence & Hay Bales	Includes Silt Fence, polypropylene, 3' high, adverse conditions & Hay Bales, staked	LF	3,000	$11.75	$35,250	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.31 25 14.16 1100 + 1250
				Subtotal	**$651,400**	
Health and Safety						
Health and Safety Plan	Prepare Site-specific health and safety plan as well as prepare community notification documents	Each	1	$10,000.00	$10,000	Engineer's Estimate
Construct Decontamination Pad & Containment	For equipment and personnel, Assume 4 setups will be needed.	Setups	4	$5,000.00	$20,000	Engineer's Estimate
Water Supply for Decontamination	Assume daily water need for decontamination process is 5,000 gallons/setup.	100 CF	749	$5.10	$3,818	2012 costs from the San Francisco Public Utilities Commission. Water price of $5.10 per 100 CF.
Community/Exclusion Zone Air Monitoring	Particulate meter purchase (Qty 4)	Each	4	$7,200.00	$28,800	Industrial Environmental Monitoring Instruments, http://www.ierents.com/ as of January 2012
Site Safety Officer	10 hrs./day, 5days/wk., $100/hr.; 100% of project duration	manweeks	6	$5,000.00	$30,000	Engineer's Estimate
				Subtotal	**$92,700**	
Construction Mob/Demob						
Construction Oversight	10 hrs./day, 5days/wk., $100/hr.; 100% of project duration	manweeks	6	$5,000.00	$30,000	Engineer's Estimate
Pre-Construction Safety Meeting	Pre-Construction safety meeting for all equipment operators and other personnel on the job. Assume 20 people will attend for 8 hours at $125/hour	Each	20	$1,000.00	$20,000	Engineer's Estimate
Mobilization for Dry Excavation Equipment	Up to 25 mile haul distance; 3 loader, 1 forklift, 2 excav., 1 grader, 1 paver, and 2 Trucks above 150 H.P.,	Each	10	$505.00	$5,050	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 54 36.50-0100
Demobilization for Dry Excavation Equipment	Up to 25 mile haul distance; 3 loader, 1 forklift, 2 excav., 1 grader, 1 paver, and 2 Trucks above 150 H.P.,	Each	10	$505.00	$5,050	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 54 36.50-0100
				Subtotal	**$60,100**	
Hydraulic/Turbidity Controls						
Hydraulic/Turbidity Controls	Assume uniform $1,000,000 placeholder for all alternatives	LS	1	$1,000,000	$1,000,000	Engineer's Estimate
				Subtotal	**$1,000,000**	

Table G-6 Cost Estimate for Mechanical Dredging for Alternative 4: Top 1 - foot removal where COCs exceed 3x RGs (with 2 exceptions), Engineered Cap, MNR and ICs
Yosemite Slough Site, San Francisco, CA

Item Description	Comment	Unit	Quantity	Unit Cost	Cost	Reference
Contaminated Sediment Removal (Sediment Excavation, Transport, and Stockpiling)						
Timber Crane Mats for Slough Access	Cost for timber mat material. Assume the Yosemite Slough width is 300 ft., the number of pieces of Mat needed to cross the Slough is: 300 ft./4ft =75. Assume 200 mats needed for the entire project.	Each	200	$785.00	$157,000	The Mat Source: http://www.thematsource.com/mat-inventory/timber-mats.html. Douglas Fir Crane Mats (12 in *4 ft. * 20 ft.), each mat consists of 4 timbers. Accessed in June 2012.
Timber Crane Mats Relocation	Backhoe Loader, 80 HP, 1 equipment operator and 2 laborers. For adjusting and relocating timber mats as needed during the project duration	Day	13	$1,888.04	$24,545	2013 RSMeans Site Work and Landscape Cost Data Crew B-11 M plus one additional laborer
Excavation of Sediment	Excavator, hydraulic, 2 CY bucket = 165 CY/hr. Assume 5 % of the volume removed would be debris.	BCY	2,495	$45.00	$112,275	Engineer's Estimate
Loading sediment onto trucks	add 15% to excavation costs	BCY	2,495	$6.75	$16,841	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.31 23 16.42-0020
Add long reach boom/arm for excavator	add 50% of the excavator costs	BCY	2,495	$22.50	$56,138	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 23 16.42-4250
Transport Sediment to Stockpile (staging area)	8 C.Y. truck, 15 MPH ave, cycle 1 mile, 30 min wait/Ld./ Uld.	LCY	2,869	$7.55	$21,663	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 23 23.20-0414
Stockpiling of Dredged Sediment	1 F.E. Loaders, Wheel Mounted, 2.5 CY capacity, 1 operator and laborer, available onsite full time during excavation, capping, restoration and demobilization activities.	Day	18	$1,371.22	$24,682	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.Crew B-10T
Sediment Dewatering	including debris removal, generator, shakers, belt press, and polymer dosage. Assumed Dewatering for mechanical and hydraulic dredging activities are equal.	LCY	2,869	$63.00	$180,763	2012 Vendor quote provided by JND Thomas Co., Inc. provided for Hydraulic dredging.
				Subtotal	**$594,000**	
Sediment Stabilization for Lead						
Sediment Stabilization	EnviroBlend CS, 1-3% wt./wt. dosage, 2000 # Supersacks, material only	Ton	45	$285.00	$12,825	2012 Vendor Quote from Premier Chemicals LLC.
ForkLift Rental	Assume Forklift rental for one day when the material would be delivered onsite	Day	1	$1,117.24	$1,117	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. Crew A-3P
Transportation Costs	Freight Costs, $1,300/22 sacks	Ton	45	$59.09	$2,659	2012 Vendor Quote from Premier Chemicals LLC.
Mixing Sediment with the product	Front End Loader, 5 CY bucket	LCY	1,150	$1.94	$2,231	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 312316.42-1350
Characterization Sampling of Treated Sediment	Assume 1 sample required per 100 LCY. Includes TCLP, STLC, TTLC testsmetals and PCBs	Each	12	$1,000.00	$12,000	Engineer's Estimate
				Subtotal	**$30,900**	
Transportation and Disposal of Non-hazardous sediment						
Characterization Sampling of Dewatered Sediment	Assume 1 sample required per 500 LCY. Includes analysis for metals and PCBs	Each	6	$1,000.00	$6,000	Engineer's Estimate
Loading Sediment onto Trucks	Front End Loader, 5 CY bucket, Assumed Loading will occur during the excavation and capping activites.	Day	8	$1,954.00	$15,632	2012 RSMeans Site Work and Landscape Cost Data 31st Ed. Crew B-10U
Transportation	Dump truck transport from Yosemite Slough to Landfill; incl taxes and fees	Ton	4,304	$50.00	$215,194	Engineer's Estimate
Disposal	Disposal at Landfill; incl taxes and fees	Ton	3,743	$50.00	$187,125	Engineer's Estimate
				Subtotal	**$424,000**	
Treatment of Dewatering Process Water						
FRAC Tank Rental; for "holding tank" of water	6 x 21,000 Tank with Cleaning	Day	28	$1,200.00	$33,600	Engineer's Estimate
Rain for Rent dewatering process water treatment system mobilization	process involves a settling tank, sand filtration, bag filter, carbon filter, resins/Organoclay, holding tank for testing	Each	1	$75,000.00	$75,000	Oakley Rain for Rent Quote from Tony DeBellis (2012)
Rain for Rent dewatering process water treatment system spent media disposal and replacement	cost is 125% of cost for mobilization for each media replacement	Each	1	$93,750.00	$93,750	Oakley Rain for Rent Quote from Tony DeBellis (2012)
Treament System Operations	One operator	Day	28	$574.00	$16,072	2013 RSMeans Site Work and Landscape Cost Data One Equip. Oper. (med)
Characterization/Monitoring Sampling of Dewatering Process Water	Including pH, TDS, TSS, COD, Metals, PCBs. Assume one sample is needed every 10000 CF of processed water.	Each	27	$1,000.00	$27,000	Engineer's Estimate
				Subtotal	**$245,500**	
Discharge of Dewatering Process Water to SFPUC						
Permit Fee		Each	1	$1,000.00	$1,000	Engineer's Estimate
Batch Discharge to SFPUC	Sewer service charge is per 100 cubic feet discharged	100 CF	2,683	$6.56	$17,603	2012 costs from the San Francisco Public Utilities Commission. Water price of $6.55 per 100 CF.
				Subtotal	**$18,700**	
Capping						
Capping Material Transportation	Assume the amount of material needed is equal to the amount sediment removed. Assume material is 1.5 ton/CY based on data from the Geotechnical Study	Ton	3,743	$50.00	$187,125	Engineer's Estimate. Source of material has not been identified at this time.
Excavator for Installation of Cap material	Excavator, hydraulic, 2 CY bucket	LCY	2,869	$40.00	$114,770	Engineer's Estimate.
Add long reach boom/arm for excavator	add 50% of the excavator costs	LCY	2,869	$20.00	$57,385	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 23 16.42-4250
				Subtotal	**$359,300**	
Post Construction Costs						
Site Restoration for Staging Area/Access Roads	grading of access roads and staging area for paving	Day	2	$1,266.02	$2,532	2013 RSMeans Site Work and Landscape Cost Data Crew B-10L - 0.5 laborer
Site Restoration for Access road/staging area	Plant-mix Asphalt Paving with binder course 2.5" thick.	SY	9680	$11.30	$109,384	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 32 12 16.13-0130
Site Restoration for Staging Area	Plant-mix Asphalt Paving with wearing course 2.5" thick.	SY	9680	$12.55	$121,484	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.32 12 16.13-0420
Project Closeout	Phase II Investigation costs	Each	1	$25,000.00	$25,000	Engineer's Estimate
				Subtotal	**$258,500**	
				Capital Costs Subtotal:	$3,760,100	
				Adjusted Capital Cost Subtotal for San Francisco, CA Location Factor (123.4):	$4,640,000	
				10% Legal and Administrative Fees	$464,000	
				20% Contingencies:	$928,000	
				Predesign Investigations	$1,000,000	Engineer's Estimate
				Construction Management (10% of total capital cost)	$464,000	Engineer's Estimate
				Engineering Design (10 % of total capital cost)	$464,000	Engineer's Estimate
				Total Capital Costs in 2013 Dollars:	**$7,960,000**	

Table G-6 Cost Estimate for Mechanical Dredging for Alternative 4: Top 1 - foot removal where COCs exceed 3x RGs (with 2 exceptions), Engineered Cap, MNR and ICs
Yosemite Slough Site, San Francisco, CA

Item Description	Comment	Unit	Quantity	Unit Cost	Cost	Reference
Monitored Natural Attenuation						
MNR Costs		LS	1	$236,840.00	$236,840	MNR costs provided by Arcadis (2012)
				Annual Cost Subtotal:	$236,840	
	Adjusted Capital Cost Subtotal for San Francisco, CA Location Factor (123.4):				$292,261	
				10% Legal and Administrative Fees	$29,226	
				20% Contingencies:	$58,452	
				Total:	**$380,000**	
Periodic (5-year) Monitoring for 30 years						
Institutional Controls	Easement, fencing, signs	LS	1	$25,000	$25,000	Engineer's Estimate
Site Monitoring		LS	1	$20,000	$20,000	Engineer's Estimate
Reporting		LS	1	$10,000	$10,000	Engineer's Estimate
				5-Year Cost Subtotal:	$55,000	
	Adjusted Capital Cost Subtotal for San Francisco, CA Location Factor (123.4):				$67,870	
				10% Legal and Administrative Fees	$6,787	
				20% Contingencies:	$13,574	
				5-Year Total:	$88,231	
	30-Year Present Worth of Periodic Monitoring Costs:				**$246,000**	
				2013 Present Worth Cost:	**$8,586,000**	

Assumptions

1. Volume of Contaminated Material (Total)	2,495	BCY, as estimated using the polygon method, E&E, 2013
2. Volume of Hazardous lead contaminated soil	1,000	BCY
3. Perimeter around staging area	3000	ft
4. Area available for Staging Area	13	acre
5. Project Duration		
Mobilization	5	days
Dewatering and Treatment system set up	5	days
Excavation	4	days — Total volume removed/excavation rate of 165 CY/HR. Assume 8 hours per day, 5 days per week, Assume 50% production rate.
Capping	4	days
Restoration	5	days
Demobilization	5	days
Total Project Duration	28	days
6. Dewatering		
Volume of water from the sediment (assume that the sediment will only have 30% water, as dewatering activities would have removed most of the water)	20209.5	CF
Volume of water that would be pumped during dewatering (assume 50 gpm, 24 hours a day during dewatering setup, excavation, capping and restoration)	173,262	CF
7. In-Situ Bulk Density assumed for the project is	1.5	Tons/BCY
8. Swell Factor was assumed to be	15%	

9. Assume access road preparation will disturb 1 acre and the staging area will disturb 1 acre for a total of 2 acres.
10. After construction activities are completed, the disturbed two acres will require pavement restoration.
11. The surveying crew will be needed for the entire project duration to compete a pre-excavation, post-excavation, and post capping surveys and to assist the excavation crew.
12. The cofferdam needed is 1000' (length) by 36' (depth). Assume that a silt curtain will be in place during the installation and removal of the cofferdam.
13. Assume 5000 gallons of water/decon setup would be needed daily for decontamination purposes. Assume this water will be treated by the dewatering process water treatment facility.
14. Approximately 200 timber crane mats will be needed for the entire project.
15. One sample is needed every 10,000 CF of processed water.
16. The Suspended Solids, Oil/Grease and COD will be removed during the sediment dewatering process.
17. Assume that there is a manhole located onsite discharge of treated dewatering process water.
18. Assume there is a fire hydrant onsite for the supply of decontamination water.
19. Onsite material from access road creation will be used to fill in depressions created by debris removal.
20. Amount of backfill material needed for bank treatment is 1000' bank length x 50' width x 2' depth.
21. Assume 10 truck loads of debris will be removed from banks.
22. Present worth of costs assumes 5% annual interest rate.
23. Unit costs listed were obtained from 2012 RS Means Cost Data and engineering judgement.
24. Institutional Controls at the site are expected to include deed restrictions, informational signs and dissemination of information by the State Parks to the general public.

Key:
LF = Linear Foot
SY = Square Yard
BCY = Bank Cubic Yard
LCY = Loose Cubic Yard
LS = Lump Sum
SF = Square Feet
CF = Cubic Feet

Table G-7 Cost Estimate for Hydraulic Dredging for Alternative 4: Top 1 - foot removal where COCs exceed 3x RGs (with 2 exceptions), Engineered Cap, MNR and ICs
Yosemite Slough Site, San Francisco, CA

Item Description	Comment	Unit	Quantity	Unit Cost	Cost	Reference
Capital Cost						
Institutional Controls		Each	1	$25,000.00	$25,000	Engineer's estimate
				Subtotal:	**$25,000**	
Preconstruction/Site Preparation						
Site Preparation, access road construction, site survey, mobilization and demobilization of equipment	Includes construction of 8" HDPE pipe for sediment transport to staging area, and launching of the dredge, See assumptions below for additional details on what is included in the mobilization costs	LS	1	$400,000.00	$400,000	Quote from JND Thomas Co, Inc.
Install Fence	Chain link industrial, 6' H, 6 gauge wire with 3 strands barb wire; around staging area	LF	3000	$30.00	$90,000	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 32 31 13.20-0500
Gate	Double swing gates, includes posts with 12' opening	Each	2	$1,100.00	$2,200	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 32 31 13.20-5060
Signs	Reflectorized 24"x 24" sign mounted to fence	Each	4	$130.00	$520	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 10 14 53.20-0100; increase by 50% for text customization
Office Trailer Rental	Office trailer, furnished, rent per month, 50' x 12' excl. hookups. + air conditioning. Assume 6 month rental	MO	6	$425.50	$2,553	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 52 13.20 0550
Office Trailer Delivery	Office trailer, delivery and pickup, assume 40 miles/round trip	MI	40	$11.65	$466	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 52 13.20 0800
Trailer Telephone	Field office expense - telephone bill; avg. bill/month, incl. long distance., Assume 6 month rental	MO	6	$89.00	$534	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 52 13.40 0140
Lights and HVAC	Field office expense - field office lights & HVAC., Assume 6 month rental	MO	6	$167.00	$1,002	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.01 52 13.40 0160
Sanitary Facilities	Rent toilet, portable, chemical, Assume 6 month rental	MO	6	$183.00	$1,098	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 54 33.40 6410 (Construciton Aids)
Three Phase power supply	Assume cost for setting up electrical service to operate equipment to be around $20,000	LS	1	$20,000.00	$20,000	Engineer's Estimate
Utility Cost during Project activities	Assume $15,000	LS	1	$15,000.00	$15,000	Engineer's Estimate
Bank Treatment Debris Removal	Cost for removing debris located along the Slough banks. Assume 1 Gradall, 3 ton, 1 CY, 1 Equipment Operator, 4 laborers	Day	5	$3,448.20	$17,241	2013 RSMeans Site Work and Landscape Cost Data Crew B-12 K + 3 laborers
Bank Treatment Transport Debris to Staging Area	Assume 50 truck loads of debris will be removed from banks. 8 C.Y. truck, 15 MPH ave, cycle 1 mile, 30 min wait/Ld./ Uld.	LCY	400	$7.55	$3,020	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 23 23.20-0414
Transportation of Collected Debris	Debris removed for staging area/access road construction and other Debris. Dump truck transport from Yosemite Slough to Landfill; incl taxes and fees	Ton	600	$50.00	$30,000	Engineer's Estimate
Disposal of Collected Debris	Debris removed for staging area/access road construction and other Debris. Disposal at Landfill; incl taxes and fees	Ton	600	$50.00	$30,000	Engineer's Estimate
Bank Treatment Backfill	Assume 1-1/2" crushed stone will be used to fill in depressions that could potentially could form during excavation activities. Assume 500 CY of fill, includes cost for spreading, 2 mi RT Haul	LCY	500	$42.00	$21,000	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.31 05 16.10 0300
Erosion and Sediment Controls - Jute Mesh	Includes Jute Mesh 100 SY per roll, 4' wide, stapled, 2 acres	SY	9,680	$2.06	$19,941	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 25 14.16 0020
Erosion and Sediment Control - Silt Fence & Hay Bales	Includes Silt Fence, polypropylene, 3' high, adverse conditions & Hay Bales, staked	LF	3,000	$11.75	$35,250	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 25 14.16 1100 + 1250
				Subtotal:	**$689,825**	
Health and Safety						
Health and Safety Plan	Prepare Site-specific health and safety plan as well as prepare community notification documents	Each	1	$10,000.00	$10,000	Engineer's Estimate
Construct Decontamination Pad & Containment	For equipment and personnel, Assume 4 setups will be needed.	Setups	4	$5,000.00	$20,000	Engineer's Estimate
Water Supply for Decontamination phases	Assume daily water need for decontamination process is 5,000 gallons/setup.	CF	1,016	$5.10	$5,182	2012 costs from the San Franciso Public Utilities Commission. Water price of $5.10 per 100 CF.
Community/Exclusion Zone Air Monitoring	Particulate meter purchase (Qty 4)	Each	4	$7,200.00	$28,800	Industrial Environmental Monitoring Instruments, http://www.ierents.com/ as of January 2012
Site Safety Officer	10 hrs/day, 5days/wk, $100/hr; 100% of project duration	manweeks	8	$5,000.00	$38,000	Engineer's Estimate
				Subtotal:	**$102,000**	
Construction Costs						
Construction Oversight	10 hrs/day, 5days/wk, $100/hr; 100% of project duration	manweeks	8	$5,000.00	$38,000	Engineer's Estimate
Pre-Construction Safety Meeting	Pre-Construction safety meeting for all equipment operators and other personnel on the job. Assume 20 people will attend for 8 hours at $125/hour	Each	20	$1,000.00	$20,000	Engineer's Estimate
				Subtotal:	**$58,000**	
Hydraulic/Turbidity Controls						
Hydraulic/Turbidity Controls	Assume uniform $1,000,000 placeholder for all alternatives	LS	1	$1,000,000	$1,000,000	Engineer's Estimate
				Subtotal:	**$1,000,000**	
Contaminated Sediment Removal (Hydraulic Dredging)						
Sediment removal and pumping to sediment dewatering plant at site access area through an 8" HDPE pipeline	using the Moray 8" Swinging Ladder Dredge	BCY	2,495	$63.00	$157,185	Vendor quote from JND Thomas Co., Inc.
Cofferdam Construction and Removal	Based on supply and installation of cofferdam	LS	1	$410,000.00	$410,000	Vendor quote from JND Thomas Co., Inc.
				Subtotal:	**$567,200**	
Sediment Dewatering and Characterization						
Mechanical Dewatering System and Dewatered Sediment Stockpiling	The dewatering system is expected to include Two Dual Tandem Shakers, Two Mix tanks, 4 14" Hydro-cyclones, Hydro-clear HC2500 Clarifier, Three belt presses, polymer dosage and additional storage tank prior to disposal to the slough. Flow is expected to be around 2000 gpm. Includes costs for Characterization and monitoring costs	LCY	2,869	$63.00	$180,763	Vendor quote from JND Thomas Co., Inc.
				Subtotal:	**$180,800**	

Table G-7 Cost Estimate for Hydraulic Dredging for Alternative 4: Top 1 - foot removal where COCs exceed 3x RGs (with 2 exceptions), Engineered Cap, MNR and ICs
Yosemite Slough Site, San Francisco, CA

Item Description	Comment	Unit	Quantity	Unit Cost	Cost	Reference
Sediment Stabilization for Lead						
Sediment Stabilization	EnviroBlend CS, 1-3% wt./wt. dosage, 2000 # Supersacks, material only	Ton	45	$285.00	$12,825	2012 Vendor Quote from Premier Chemicals LLC.
Transportation Costs	Freight Costs, $1,300/22 sacks	Ton	45	$59.09	$2,659	2012 Vendor Quote from Premier Chemicals LLC.
ForkLift Rental	Assume Forklift rental for one day when the material would be delivered onsite	Day	1	$1,117.24	$1,117	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. Crew A-3P
Mixing Sediment with the product	Front End Loader, 5 CY bucket	LCY	1,150	$1.94	$2,231	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 312316.42-1350
Characterization Sampling of Treated Sediment	Assume 1 sample required per 100 LCY. Includes TCLP, STLC, TTLC testsmetals and PCBs	Each	12	$1,000.00	$12,000	Engineer's Estimate
				Subtotal:	**$30,900**	
Transportation and Disposal of Non-hazardous sediment						
Characterization Sampling of Dewatered Sediment	Assume 1 sample required per 500 LCY. Includes analysis for total metals and PCBs, TCLP, hexavelent chromium, paint filter test	Each	6	$1,000.00	$6,000	
Loading Sediment onto Trucks	Front End Loader, 5 CY bucket, Assumed Loading will occur during the excavation and capping activites.	day	18	$1,954.00	$35,172	2012 RSMeans Site Work and Landscape Cost Data 31st Ed. Crew B-10U
Transportation	Dump truck transport from Yosemite Slough to Landfill; incl taxes and fees	Ton	3,743	$50.00	$187,125	Engineer's Estimate
Disposal	Disposal at Landfill; incl taxes and fees	Ton	3,743	$50.00	$187,125	Engineer's Estimate
				Subtotal:	**$415,500**	
Treatment of Decontamination Process Water						
FRAC Tank Rental; for "holding tank" of water	4 x 21,000 Tank with Cleaning	Day	38	$800.00	$30,400	Engineer's Estimate
Rain for Rent dewatering process water treatment system mobilization	process involves a settling tank, sand filtration, bag filter, carbon filter, resins/Organoclay, holding tank for testing	Each	1	$75,000.00	$75,000	Oakley Rain for Rent Quote from Tony DeBellis (2012)
Rain for Rent dewatering process water treatment system spent media disposal and replacement	cost is 125% of cost for mobilization for each medial replacement	Each	1	$93,750.00	$93,750	Oakley Rain for Rent Quote from Tony DeBellis (2012)
Treament System Operations	One operator	Day	38	$574.00	$21,812	2013 RSMeans Site Work and Landscape Cost Data One Equip. Oper. (med)
Characterization/Monitoring Sampling of Dewatering Process Water	Including pH, TDS, TSS, COD, Total Metals, PCBs. Assume one sample is needed every 10000 CF of processed water.	Each	16	$1,000.00	$16,000	Engineer's Estimate
				Subtotal:	**$237,000**	
Discharge of Dewatering Process Water to SFPUC						
Permit Fee		Each	1	$1,000.00	$1,000	Engineer's Estimate
Batch Discharge to SFPUC	Sewer service charge is per 100 cubic feet discharged. Only for Water from the decon activities	CF	55,016	$6.56	$360,905	2012 costs from the San Franciso Public Utilities Commission. Water price of $6.55 per 100 CF.
				Subtotal:	**$362,000**	
Capping						
Capping Material Transportation	Assume the amount of material needed is equal to the amount sediment removed. Assume material is 1.5 ton/CY based on data from the Geotechnical Study	Ton	27	$50.00	$1,350	Engineer's Estimate. Source of material has not been identified at this time.
Excavator for Installation of Cap material	Excavator, hydraulic, 2 CY bucket	LCY	1,000	$40.00	$40,000	Engineer's Estimate.
Add long reach boom/arm for excavator	add 50% of the excavator costs	LCY	1,000	$20.00	$20,000	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.31 23 16.42-4250
				Subtotal	**$61,400**	
Post Construction Costs						
Site Restoration for Access Roads	grading of access roads	Day	2	$1,266.02	$2,532	2013 RSMeans Site Work and Landscape Cost Data Crew B-10L - 0.5 laborer
Site Restoration for Staging Area	Plant-mix Asphalt Paving with wearing course 2.5" thick. Assume 2 acres will be disturbed	SY	9680	$12.55	$121,484	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 12 16.13-0420
Project Closeout	Phase II Investigation costs	Each	1	$25,000.00	$25,000	Engineer's Estimate
				Subtotal	**$149,100**	
				Capital Costs Subtotal:	$3,878,725	
				Adjusted Capital Cost Subtotal for San Francisco, CA Location Factor (123.4):	$4,786,400	
				10% Legal and Administrative Fees	$478,700	
				20% Contingencies:	$957,300	
				Predesign Investigations	$1,000,000	Engineer's Estimate
				Construction Management (10% of total capital cost)	$478,700	Engineer's Estimate
				Engineering Design 10 % of total capital cost	$478,700	Engineer's Estimate
				Total Capital Costs in 2013 Dollars:	**$8,180,000**	
Monitored Natural Attenuation						
MNR Costs		LS	1	$236,840.00	$236,840	MNR costs provided by Arcadis (2012)
				Annual Cost Subtotal:	$236,840	
				Adjusted Capital Cost Subtotal for San Francisco, CA Location Factor (123.4):	$292,261	
				10% Legal and Administrative Fees	$29,226	
				20% Contingencies:	$58,452	
				Total:	**$380,000**	
Periodic (5-year) Monitoring for 30 years						
Institutional Controls	Easement, fencing, signs	LS	1	$25,000	$25,000	Engineer's Estimate
Site Monitoring		LS	1	$20,000	$20,000	Engineer's Estimate
Reporting		LS	1	$10,000	$10,000	Engineer's Estimate
				5-Year Cost Subtotal:	$55,000	
				Adjusted Capital Cost Subtotal for San Francisco, CA Location Factor (123.4):	$67,870	
				10% Legal and Administrative Fees	$6,787	
				20% Contingencies:	$13,574	
				5-Year Total:	$88,231	
				30-Year Present Worth of 5-Year Costs:	**$246,000**	
				2013 Present Worth Cost:	**$8,806,000**	

Table G-7 Cost Estimate for Hydraulic Dredging for Alternative 4: Top 1 - foot removal where COCs exceed 3x RGs (with 2 exceptions), Engineered Cap, MNR and ICs
Yosemite Slough Site, San Francisco, CA

Item Description	Comment	Unit	Quantity	Unit Cost	Cost	Reference
Assumptions						
1. Volume of Contaminated Material	2,495	BCY, as estimated using the polygon method, E&E, 2012				
2. Volume of Hazardous lead contaminated soil	1,000	BCY				
3. Perimeter around staging area	3000	ft				
4. Area available for Staging Area	13	acre				
5. Project Duration						
Mobilization	5	days				
Dewatering and Treatment system set up	5	days				
Dredging	9	days	Dredging rate is 300 CY/day. Assume 5 days per week			
Capping	9	days				
Restoration	5	days				
Demobilization	5	days				
Total Project Duration	38	days				
6. Volume of water generated from staging area activities (the dewatering water treatment costs have been included in the vendor cost for dewatering activities)	54,000	CF				
7. In-Situ Bulk Density assumed for the project is	1.5	Tons/BCY				
8. Swell Factor was assumed to be	15%					

9. Assume access road preparation will disturb 1 acre and the staging area will disturb 1 acre for a total of 2 acres.
10. After construction activities are completed, the disturbed two acres will require pavement restoration.
11. The surveying crew will be needed for the entire project duration to compete a pre-excavation, post-excavation, and post capping surveys and to assist the excavation crew.
12. Two cofferdams will be installed to contain the flow during the hydraulic dredging activities. Assume that a silt curtain will be installed as part of this process.
13. Assume 10,000 gallons of water would be needed daily for decontamination purposes. Assume this water will be treated by the dewatering process water treatment facility.
14. One sample is needed every 10,000 CF of processed water.
15. The Suspended Solids, Oil/Grease and COD will be removed during the sediment dewatering process.
16. Assume that there is a manhole located onsite discharge of treated dewatering process water.
17. Assume there is a fire hydrant onsite for the supply of decontamination water.
18. Onsite material from access road creation will be used to fill in depressions created by debris removal.
19. Amount of backfill material needed for bank treatment is 1000' bank length x 50' width x 2' depth.
20. Assume 50 truck loads of debris will be removed from banks.
21. Present worth of costs assumes 5% annual interest rate.
22. Unit costs listed were obtained from 2012 RS Means Cost Data and engineering judgement.
23. Mobilization costs provided by the vendor includes three phases of mobilization. Phase I includes obtaining permits, constructing access roads, site prep, erosion/stormwater control fencing, safety
24. Institutional Controls at the site are expected to include deed restrictions, informational signs and dissemination of information by the State Parks to the general public.

Key:
LF = Linear Foot
SY = Square Yard
BCY = Bank Cubic Yard
LCY = Loose Cubic Yard
LS = Lump Sum
SF = Square Feet
CF = Cubic Feet

Table G-8 Cost Estimate for Mechanical Dredging for Alternative 5: Top 1 - foot removal where COCs exceed RGs, 2-foot removal in same areas where COCs exceed RGs, Engineered Cap, Yosemite Slough Site, San Francisco, CA

Item Description	Comment	Unit	Quantity	Unit Cost	Cost	Reference
Capital Cost						
Institutional Controls		Each	1	$25,000.00	$25,000	Engineer's estimate
				Subtotal	**$25,000**	
Preconstruction/Site Preparation						
Surveying Crew	assume availability of the crew during mobilization/demobilization for pre- and post-construction surveys and during excavation/capping.	Day	42	$1,889.31	$79,351	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.Crew A-7
Cut and Chip Trees	Trees to 6" dia.; assume 1 acre for haul roads and one acre for staging areas	Acre	2	$4,625.00	$9,250	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.31 11 10.10-0020
Grub Stumps and Remove	Trees to 6" dia.; assume 1 acre for haul roads and one acre for staging areas	Acre	2	$2,050.00	$4,100	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 11 10.10-0150
Strip topsoil and Stockpile	200 HP Dozer, adverse conditions; Assume top 6" would be stripped and stockpiled for disposal	CY	1614	$0.98	$1,582	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.31 14 13.23 0020
Crushed Stone for establishing haul roads and staging areas	Assume 6" layer of Crushed Stone, spread with 200 HP Dozer, no compaction, 2 mi. RT haul	CY	1614	$42.00	$67,788	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.31 05 16.10 0300
Compaction	Riding, Vibrating Roller, 6" Lifts, 2 passes	CY	1614	$0.45	$726	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.31 23 23.23 5000
Grading	Grading subgrade for base course, roadways.	SY	9680	$0.20	$1,936	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 22 16.10 3300
Install Fence	Chain link industrial, 6' H, 6 gauge wire with 3 strands barb wire; around staging area	LF	3000	$30.00	$90,000	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 32 31 13.20-0500
Gate	Double swing gates, includes posts with 12' opening	Each	2	$1,100.00	$2,200	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 32 31 13.20-5060
Signs	Reflectorized 24"x 24" sign mounted to fence	Each	4	$130.00	$520	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.10 14 53.20-0100; increase by 50% for text customization
Office Trailer Rental	Office trailer, furnished, rent per month, 50' x 12' excl. hookups. + air conditioning. Assume 6 month rental	MO	6	$425.50	$2,553	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.01 52 13.20 0550
Office Trailer Delivery	Office trailer, delivery and pickup, assume 40 miles/round trip	MI	40	$11.65	$466	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 52 13.20 0800
Trailer Telephone	Field office expense - telephone bill; avg. bill/month, incl. long distance., Assume 6 month rental	MO	6	$89.00	$534	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 52 13.40 0140
Lights and HVAC	Field office expense - field office lights & HVAC., Assume 6 month rental	MO	6	$167.00	$1,002	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.01 52 13.40 0160
Sanitary Facilities	Rent toilet, portable, chemical, Assume 6 month rental	MO	6	$183.00	$1,098	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 54 33.40 6410 (Construciton Aids)
Three Phase power supply	Assume cost for setting up electrical service to operate equipment to be around $20,000	LS	1	$20,000.00	$20,000	Engineer's Estimate
Utility Cost during Project activities	Assume $15,000	LS	1	$15,000.00	$15,000	Engineer's Estimate
Bank Treatment Debris Removal	Cost for removing debris located along the Slough banks. Assume 1 Gradall, 3 ton, 1 CY, 1 Equipment Operator, 4 laborers	Day	5	$3,448.20	$17,241	2013 RSMeans Site Work and Landscape Cost Data Crew B-12 K + 3 laborers
Bank Treatment Transport Debris to Staging Area	Assume 50 truck loads of debris will be removed from banks. 8 C.Y. truck, 15 MPH ave, cycle 1 mile, 30 min wait/Ld./ Uld.	CY	400	$7.55	$3,020	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 23 23.20-0414
Transportation of Collected Debris	Debris removed for staging area/access road construction and other Debris. Dump truck transport from Yosemite Slough to Landfill; incl taxes and fees	Ton	3,021	$50.00	$151,050	Engineer's Estimate
Disposal of Collected Debris	Debris removed for staging area/access road construction and other Debris. Disposal at Landfill; incl taxes and fees	Ton	3,021	$50.00	$151,050	Engineer's Estimate
Bank Treatment Backfill	Assume 1-1/2" crushed stone will be used to fill in depressions that could potentially could form during excavation activities. Assume 500 CY of fill, includes cost for spreading, 2 mi RT Haul	LCY	500	$42.00	$21,000	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 05 16.10 0300
Erosion and Sediment Controls - Jute Mesh	Includes Jute Mesh 100 SY per roll, 4' wide, stapled	SY	9,680	$2.06	$19,941	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.31 25 14.16 0020
Erosion and Sediment Control - Silt Fence & Hay Bales	Includes Silt Fence, polypropylene, 3' high, adverse conditions & Hay Bales, staked	LF	3,000	$11.75	$35,250	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 25 14.16 1100 + 1250
				Subtotal	**$696,700**	
Health and Safety						
Health and Safety Plan	Prepare Site-specific health and safety plan as well as prepare community notification documents	Each	1	$10,000.00	$10,000	Engineer's Estimate
Construct Decontamination Pad & Containment	For equipment and personnel, Assume 4 setups will be needed.	Setups	5	$5,000.00	$25,000	Engineer's Estimate
Water Supply for Decontamination	Assume daily water need for decontamination process is 5,000 gallons/setup.	100 CF	1,390	$5.10	$7,091	2012 costs from the San Francisco Public Utilities Commission. Water price of $5.10 per 100 CF.
Community/Exclusion Zone Air Monitoring	Particulate meter purchase (Qty 4)	Each	4	$7,200.00	$28,800	Industrial Environmental Monitoring Instruments, http://www.ierents.com/ as of January 2012
Site Safety Officer	10 hrs./day, 5days/wk., $100/hr.; 100% of project duration	manweeks	11	$5,000.00	$55,000	Engineer's Estimate
				Subtotal	**$125,900**	
Construction Mob/Demob						
Construction Oversight	10 hrs./day, 5days/wk., $100/hr.; 100% of project duration	manweeks	11	$5,000.00	$55,000	Engineer's Estimate
Pre-Construction Safety Meeting	Pre-Construction safety meeting for all equipment operators and other personnel on the job. Assume 20 people will attend for 8 hours at $125/hour	Each	20	$1,000.00	$20,000	Engineer's Estimate
Mobilization for Dry Excavation Equipment	Up to 25 mile haul distance; 3 loader, 1 forklift, 2 excav., 1 grader, 1 paver, and 2 Trucks above 150 H.P.,	Each	10	$505.00	$5,050	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 54 36.50-0100
Demobilization for Dry Excavation Equipment	Up to 25 mile haul distance; 3 loader, 1 forklift, 2 excav., 1 grader, 1 paver, and 2 Trucks above 150 H.P.,	Each	10	$505.00	$5,050	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 54 36.50-0100
				Subtotal	**$85,100**	
Hydraulic/Turbidity Controls						
Hydraulic/Turbidity Controls	Assume uniform $1,000,000 placeholder for all alternatives	LS	1	$1,000,000	$1,000,000	Engineer's Estimate
				Subtotal	**$1,000,000**	

Table G-8 Cost Estimate for Mechanical Dredging for Alternative 5: Top 1 - foot removal where COCs exceed RGs, 2-foot removal in same areas where COCs exceed RGs, Engineered Cap, Yosemite Slough Site, San Francisco, CA

Item Description	Comment	Unit	Quantity	Unit Cost	Cost	Reference
Contaminated Sediment Removal (Sediment Excavation, Transport, and Stockpiling)						
Timber Crane Mats for Slough Access	Cost for timber mat material. Assume the Yosemite Slough width is 300 ft., the number of pieces of Mat needed to cross the Slough is: 300 ft./4ft =75. Assume 200 mats needed for the entire project.	Each	200	$785.00	$157,000	The Mat Source: http://www.thematsource.com/mat-inventory/timber-mats.html. Douglas Fir Crane Mats (12 in *4 ft. * 20 ft.), each mat consists of 4 timbers. Accessed in June 2012.
Timber Crane Mats Relocation	Backhoe Loader, 80 HP, 1 equipment operator and 2 laborers. For adjusting and relocating timber mats as needed during the project duration	Day	37	$1,888.04	$69,857	2013 RSMeans Site Work and Landscape Cost Data Crew B-11 M plus one additional laborer
Excavation of Sediment	Excavator, hydraulic, 2 CY bucket = 165 CY/hr. Assume 5 % of the volume removed would be debris.	BCY	9,939	$45.00	$447,255	Engineer's Estimate
Loading sediment onto trucks	add 15% to excavation costs	BCY	9,939	$6.75	$67,088	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.31 23 16.42-0020
Add long reach boom/arm for excavator	add 50% of the excavator costs	BCY	9,939	$22.50	$223,628	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 23 16.42-4250
Transport Sediment to Stockpile (staging area)	8 C.Y. truck, 15 MPH ave, cycle 1 mile, 30 min wait/Ld./ Uld.	LCY	11,430	$7.55	$86,295	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 23 23.20-0414
Stockpiling of Dredged Sediment	1 F.E. Loaders, Wheel Mounted, 2.5 CY capacity, 1 operator and laborer, available onsite full time during excavation, capping, restoration and demobilization activities.	Day	42	$1,371.22	$57,591	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.Crew B-10T
Sediment Dewatering	including debris removal, generator, shakers, belt press, and polymer dosage. Assumed Dewatering for mechanical and hydraulic dredging activities are equal.	LCY	11,430	$63.00	$720,081	2012 Vendor quote provided by JND Thomas Co., Inc. provided for Hydraulic dredging.
				Subtotal	**$1,828,800**	
Sediment Stabilization for Lead						
Sediment Stabilization	EnviroBlend CS, 1-3% wt./wt. dosage, 2000 # Supersacks, material only	Ton	135	$285.00	$38,475	2012 Vendor Quote from Premier Chemicals LLC.
Transportation Costs	Freight Costs, $1,300/22 sacks	Ton	135	$59.09	$7,977	2012 Vendor Quote from Premier Chemicals LLC.
ForkLift Rental	Assume Forklift rental for one day when the material would be delivered onsite	Day	1	$1,117.24	$1,117	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.Crew A-3P
Mixing Sediment with the product	Front End Loader, 5 CY bucket	LCY	3,450	$1.94	$6,693	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.312316.42-1350
Characterization Sampling of Treated Sediment	Assume 1 sample required per 100 LCY. Includes TCLP, STLC, TTLC testsmetals and PCBs	Each	35	$1,000.00	$35,000	Engineer's Estimate
				Subtotal	**$89,300**	
Transportation and Disposal of Non-hazardous sediment						
Characterization Sampling of Dewatered Sediment	Assume 1 sample required per 500 LCY. Includes analysis for metals and PCBs	Each	23	$1,000.00	$23,000	Engineer's Estimate
Loading Sediment onto Trucks	Front End Loader, 5 CY bucket, Assumed Loading will occur during the excavation and capping activites.	Day	32	$1,954.00	$62,528	2012 RSMeans Site Work and Landscape Cost Data 31st Ed. Crew B-10U
Transportation	Dump truck transport from Yosemite Slough to Landfill; incl taxes and fees	Ton	14,909	$50.00	$745,425	Engineer's Estimate
Disposal	Disposal at Landfill; incl taxes and fees	Ton	14,909	$50.00	$745,425	Engineer's Estimate
				Subtotal	**$1,576,400**	
Treatment of Dewatering Process Water						
FRAC Tank Rental; for "holding tank" of water	6 x 21,000 Tank with Cleaning	Day	52	$1,200.00	$62,400	Engineer's Estimate
Rain for Rent dewatering process water treatment system mobilization	process involves a settling tank, sand filtration, bag filter, carbon filter, resins/Organoclay, holding tank for testing	Each	1	$75,000.00	$75,000	Oakley Rain for Rent Quote from Tony DeBellis (2012)
Rain for Rent dewatering process water treatment system spent media disposal and replacement	cost is 125% of cost for mobilization for each media replacement	Each	1	$93,750.00	$93,750	Oakley Rain for Rent Quote from Tony DeBellis (2012)
Treament System Operations	One operator	Day	52	$574.00	$29,848	2013 RSMeans Site Work and Landscape Cost Data One Equip. Oper. (med)
Characterization/Monitoring Sampling of Dewatering Process Water	Including pH, TDS, TSS, COD, Metals, PCBs. Assume one sample is needed every 10000 CF of processed water.	Each	63	$1,000.00	$63,000	Engineer's Estimate
				Subtotal	**$324,000**	
Discharge of Dewatering Process Water to SFPUC						
Permit Fee		Each	1	$1,000.00	$1,000	Engineer's Estimate
Batch Discharge to SFPUC	Sewer service charge is per 100 cubic feet discharged	100 CF	6,238	$6.56	$40,923	2012 costs from the San Franciso Public Utilities Commission. Water price of $6.55 per 100 CF.
				Subtotal	**$42,000**	
Capping						
Capping Material Transportation	Assume the amount of material needed is equal to the amount sediment removed. Assume material is 1.5 ton/CY based on data from the Geotechnical Study	Ton	14,909	$50.00	$745,425	Engineer's Estimate. Source of material has not been identified at this time.
Excavator for Installation of Cap material	Excavator, hydraulic, 2 CY bucket	LCY	11,430	$40.00	$457,194	Engineer's Estimate.
Add long reach boom/arm for excavator	add 50% of the excavator costs	LCY	11,430	$20.00	$228,597	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.31 23 16.42-4250
				Subtotal	**$1,431,300**	
Post Construction Costs						
Site Restoration for Staging Area/Access Roads	grading of access roads and staging area for paving	Day	2	$1,266.02	$2,532	2013 RSMeans Site Work and Landscape Cost Data Crew B-10L - 0.5 laborer
Site Restoration for Access road/staging area	Plant-mix Asphalt Paving with binder course 2.5" thick.	SY	9680	$11.30	$109,384	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.32 12 16.13-0130
Site Restoration for Staging Area	Plant-mix Asphalt Paving with wearing course 2.5" thick.	SY	9680	$12.55	$121,484	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 32 12 16.13-0420
Project Closeout	Phase II Investigation costs	Each	1	$25,000.00	$25,000	Engineer's Estimate
				Subtotal	**$258,500**	
				Capital Costs Subtotal:	$7,483,000	
				Adjusted Capital Cost Subtotal for San Francisco, CA Location Factor (123.4):	$9,234,100	
				10% Legal and Administrative Fees	$923,500	
				20% Contingencies:	$1,846,900	
				Predesign Investigations:	$1,000,000	Engineer's Estimate
				Construction Management (10% of total capital cost)	$923,500	Engineer's Estimate
				Engineering Design (10 % of total capital cost)	$923,500	Engineer's Estimate
				Total Capital Costs in 2013 Dollars:	**$14,852,000**	
Monitored Natural Attenuation						
MNR Costs		LS	1	$236,840.00	$236,840	MNR costs provided by Arcadis (2012)
				Annual Cost Subtotal:	$236,840	
				Adjusted Capital Cost Subtotal for San Francisco, CA Location Factor (123.4):	$292,261	
				10% Legal and Administrative Fees	$29,226	
				20% Contingencies:	$58,452	
				Total:	**$380,000**	

Table G-8 Cost Estimate for Mechanical Dredging for Alternative 5: Top 1 - foot removal where COCs exceed RGs, 2-foot removal in same areas where COCs exceed RGs, Engineered Cap, Yosemite Slough Site, San Francisco, CA

Item Description	Comment	Unit	Quantity	Unit Cost	Cost	Reference
Periodic (5-year) Monitoring for 30 years						
Institutional Controls	Easement, fencing, signs	LS	1	$25,000	$25,000	Engineer's Estimate
Site Monitoring		LS	1	$20,000	$20,000	Engineer's Estimate
Reporting		LS	1	$10,000	$10,000	Engineer's Estimate
				5-Year Cost Subtotal:	$55,000	
				Adjusted Capital Cost Subtotal for San Francisco, CA Location Factor (123.4):	$67,870	
				10% Legal and Administrative Fees	$6,787	
				20% Contingencies:	$13,574	
				5-Year Total:	$88,231	
				30-Year Present Worth of Periodic Monitoring Costs:	**$246,000**	
				2013 Present Worth Cost:	**$15,478,000**	

Assumptions

1. Volume of Contaminated Material — 9,939 BCY, as estimated using the polygon method, E&E, 2013
2. Volume of Hazardous lead contaminated soil — 3,000 BCY
3. Perimeter around staging area — 3000 ft
4. Area available for Staging Area — 13 acre
5. Project Duration
   - Mobilization — 5 days
   - Dewatering and Treatment system set up — 5 days
   - Excavation — 16 days
   - Capping — 16 days
   - Restoration — 5 days
   - Demobilization — 5 days
   - Total Project Duration — 52 days

   Total volume removed/excavation rate of 165 CY/HR. Assume 8 hours per day, 5 days per week, Assume 50% production rate.
6. Dewatering
   - Volume of water from the sediment (assume that the sediment will only have 30% water, as dewatering activities would have removed most of the water) — 80505.9 CF
   - Volume of water that would be pumped during dewatering (assume 50 gpm, 24 hours a day during dewatering setup, excavation, capping and restoration) — 404,278 CF
7. In-Situ Bulk Density assumed for the project is — 1.5 Tons/BCY
8. Swell Factor was assumed to be — 15%
9. Assume access road preparation will disturb 1 acre and the staging area will disturb 1 acre for a total of 2 acres.
10. After construction activities are completed, the disturbed two acres will require pavement restoration.
11. The surveying crew will be needed for the entire project duration to compete a pre-excavation, post-excavation, and post capping surveys and to assist the excavation crew.
12. The cofferdam needed is 1000' (length) by 36' (depth). Assume that a silt curtain will be in place during the installation and removal of the cofferdam.
13. Assume 5000 gallons of water/decon setup would be needed daily for decontamination purposes. Assume this water will be treated by the dewatering process water treatment facility.
14. Approximately 200 timber crane mats will be needed for the entire project.
15. One sample is needed every 10,000 CF of processed water.
16. The Suspended Solids, Oil/Grease and COD will be removed during the sediment dewatering process.
17. Assume that there is a manhole located onsite discharge of treated dewatering process water.
18. Assume there is a fire hydrant onsite for the supply of decontamination water.
19. Onsite material from access road creation will be used to fill in depressions created by debris removal.
20. Amount of backfill material needed for bank treatment is 1000' bank length x 50' width x 2' depth.
21. Assume 10 truck loads of debris will be removed from banks.
22. Present worth of costs assumes 5% annual interest rate.
23. Unit costs listed were obtained from 2012 RS Means Cost Data and engineering judgement.
24. Institutional Controls at the site are expected to include deed restrictions, informational signs and dissemination of information by the State Parks to the general public.

Key:
LF = Linear Foot
SY = Square Yard
BCY = Bank Cubic Yard
LCY = Loose Cubic Yard
LS = Lump Sum
SF = Square Feet
CF = Cubic Feet

Table G-9 Cost Estimate for Hydraulic Dredging for Alternative 5: Top 1 - foot removal where COCs exceed RGs, 2-foot removal in same areas where COCs exceed RGs, Engineered Cap, MNR
Yosemite Slough Site, San Francisco, CA

Item Description	Comment	Unit	Quantity	Unit Cost	Cost	Reference
Capital Cost						
Institutional Controls		Each	1	$25,000.00	$25,000	Engineer's estimate
				Subtotal:	**$25,000**	
Preconstruction/Site Preparation						
Site Preparation, access road construction, site survey, mobilization and demobilization of equipment	Includes construction of 8" HDPE pipe for sediment transport to staging area, and launching of the dredge, See assumptions below for additional details on what is included in the mobilization costs	LS	1	$400,000.00	$400,000	Quote from JND Thomas Co, Inc.
Install Fence	Chain link industrial, 6' H, 6 gauge wire with 3 strands barb wire; around staging area	LF	3000	$30.00	$90,000	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 32 31 13.20-0500
Gate	Double swing gates, includes posts with 12' opening	Each	2	$1,100.00	$2,200	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 32 31 13.20-5060
Signs	Reflectorized 24"x 24" sign mounted to fence	Each	4	$130.00	$520	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.10 14 53.20-0100; increase by 50% for text customization
Office Trailer Rental	Office trailer, furnished, rent per month, 50' x 12' excl. hookups. + air conditioning. Assume 6 month rental	MO	6	$425.50	$2,553	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 52 13.20 0550
Office Trailer Delivery	Office trailer, delivery and pickup, assume 40 miles/round trip	MI	40	$11.65	$466	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 52 13.20 0800
Trailer Telephone	Field office expense - telephone bill; avg. bill/month, incl. long distance., Assume 6 month rental	MO	6	$89.00	$534	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 52 13.40 0140
Lights and HVAC	Field office expense - field office lights & HVAC., Assume 6 month rental	MO	6	$167.00	$1,002	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.01 52 13.40 0160
Sanitary Facilities	Rent toilet, portable, chemical, Assume 6 month rental	MO	6	$183.00	$1,098	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 54 33.40 6410 (Construciton Aids)
Bank Treatment Debris Removal	Cost for removing debris located along the Slough banks. Assume 1 Gradall, 3 ton, 1 CY, 1 Equipment Operator, 4 laborers	Day	5	$3,448.20	$17,241	2013 RSMeans Site Work and Landscape Cost Data Crew B-12 K + 3 laborers
Bank Treatment Transport Debris to Staging Area	Assume 50 truck loads of debris will be removed from banks. 8 C.Y. truck, 15 MPH ave, cycle 1 mile, 30 min wait/Ld./ Uld.	LCY	400	$7.55	$3,020	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31st Ed. 31 23 23.20-0414
Transportation of Collected Debris	Debris removed for staging area/access road construction and other Debris. Dump truck transport from Yosemite Slough to Landfill; incl taxes and fees	Ton	600	$50.00	$30,000	Engineer's Estimate
Disposal of Collected Debris	Debris removed for staging area/access road construction and other Debris. Disposal at Landfill; incl taxes and fees	Ton	600	$50.00	$30,000	Engineer's Estimate
Bank Treatment Backfill	Assume 1-1/2" crushed stone will be used to fill in depressions that could potentially could form during excavation activities. Assume 500 CY of fill, includes cost for spreading, 2 mi RT Haul	LCY	500	$42.00	$21,000	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 05 16.10 0300
Erosion and Sediment Controls - Jute Mesh	Includes Jute Mesh 100 SY per roll, 4' wide, stapled, 2 acres	SY	9,680	$2.06	$19,941	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 25 14.16 0020
Erosion and Sediment Control - Silt Fence & Hay Bales	Includes Silt Fence, polypropylene, 3' high, adverse conditions & Hay Bales, staked	LF	3,000	$11.75	$35,250	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.31 25 14.16 1100 + 1250
				Subtotal:	**$654,825**	
Health and Safety						
Health and Safety Plan	Prepare Site-specific health and safety plan as well as prepare community notification documents	Each	1	$10,000.00	$10,000	Engineer's Estimate
Construct Decontamination Pad & Containment	For equipment and personnel, Assume 4 setups will be needed.	Setups	4	$5,000.00	$20,000	Engineer's Estimate
Water Supply for Decontamination phases	Assume daily water need for decontamination process is 5,000 gallons/setup.	CF	2,353	$5.10	$12,000	2012 costs from the San Franciso Public Utilities Commission. Water price of $5.10 per 100 CF.
Community/Exclusion Zone Air Monitoring	Particulate meter purchase (Qty 4)	Each	4	$7,200.00	$28,800	Industrial Environmental Monitoring Instruments, http://www.ierents.com/ as of January 2012
Site Safety Officer	10 hrs/day, 5days/wk, $100/hr; 100% of project duration	manweeks	18	$5,000.00	$88,000	Engineer's Estimate
				Subtotal:	**$158,800**	
Construction Costs						
Construction Oversight	10 hrs/day, 5days/wk, $100/hr; 100% of project duration	manweeks	18	$5,000.00	$88,000	Engineer's Estimate
Pre-Construction Safety Meeting	Pre-Construction safety meeting for all equipment operators and other personnel on the job. Assume 20 people will attend for 8 hours at $125/hour	Each	20	$1,000.00	$20,000	Engineer's Estimate
				Subtotal:	**$108,000**	
Hydraulic/Turbidity Controls						
Hydraulic/Turbidity Controls	Assume uniform $1,000,000 placeholder for all alternatives	LS	1	$1,000,000	$1,000,000	Engineer's Estimate
				Subtotal:	**$1,000,000**	
Contaminated Sediment Removal (Hydraulic Dredging)						
Sediment removal and pumping to sediment dewatering plant at site access area through an 8" HDPE pipeline	using the Moray 8" Swinging Ladder Dredge	BCY	9,939	$63.00	$626,157	Vendor quote from JND Thomas Co., Inc.
Cofferdam Construction and Removal	Based on supply and installation of cofferdam	LS	1	$410,000.00	$410,000	Vendor quote from JND Thomas Co., Inc.
				Subtotal:	**$1,036,200**	
Sediment Dewatering and Characterization						
Mechanical Dewatering System and Dewatered Sediment Stockpiling	The dewatering system is expected to include Two Dual Tandem Shakers, Two Mix tanks, 4 14" Hydro-cyclones, Hydro-clear HC2500 Clarifier, Three belt presses, polymer dosage and additional storage tank prior to disposal to the slough. Flow is expected to be around 2000 gpm. Includes costs for Characterization and monitoring costs	LCY	11,430	$63.00	$720,081	Vendor quote from JND Thomas Co., Inc.
				Subtotal:	**$720,100**	

Table G-9 Cost Estimate for Hydraulic Dredging for Alternative 5: Top 1 - foot removal where COCs exceed RGs, 2-foot removal in same areas where COCs exceed RGs, Engineered Cap, MNR Yosemite Slough Site, San Francisco, CA

Item Description	Comment	Unit	Quantity	Unit Cost	Cost	Reference
Sediment Stabilization for Lead						
Sediment Stabilization	EnviroBlend CS, 1-3% wt./wt. dosage, 2000 # Supersacks, material only	Ton	135	$285.00	$38,475	2012 Vendor Quote from Premier Chemicals LLC.
Transportation Costs	Freight Costs, $1,300/22 sacks	Ton	135	$59.09	$7,977	2012 Vendor Quote from Premier Chemicals LLC.
ForkLift Rental	Assume Forklift rental for one day when the material would be delivered onsite	Day	1	$1,117.24	$1,117	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. Crew A-3P
Mixing Sediment with the product	Front End Loader, 5 CY bucket	LCY	3,450	$1.94	$6,693	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.312316.42-1350
Characterization Sampling of Treated Sediment	Assume 1 sample required per 100 LCY. Includes TCLP, STLC, TTLC testsmetals and PCBs	Each	35	$1,000.00	$35,000	Engineer's Estimate
				Subtotal:	**$89,300**	
Transportation and Disposal of Non-hazardous sediment						
Characterization Sampling of Dewatered Sediment	Assume 1 sample required per 500 LCY. Includes analysis for total metals and PCBs, TCLP, hexavelent chromium, paint filter test	Each	23	$1,000.00	$23,000	
Loading Sediment onto Trucks	Front End Loader, 5 CY bucket, Assumed Loading will occur during the excavation and capping activites.	Day	68	$1,954.00	$132,872	2012 RSMeans Site Work and Landscape Cost Data 31st Ed. Crew B-10U
Transportation	Dump truck transport from Yosemite Slough to Landfill; incl taxes and fees	Ton	14,909	$50.00	$745,425	Engineer's Estimate
Disposal	Disposal at Landfill; incl taxes and fees	Ton	14,909	$50.00	$745,425	Engineer's Estimate
				Subtotal:	**$1,646,800**	
Treatment of Decontamination Process Water						
FRAC Tank Rental; for "holding tank" of water	4 x 21,000 Tank with Cleaning	Day	88	$800.00	$70,400	Engineer's Estimate
Rain for Rent dewatering process water treatment system mobilization	process involves a settling tank, sand filtration, bag filter, carbon filter, resins/Organoclay, holding tank for testing	Each	1	$75,000.00	$75,000	Oakley Rain for Rent Quote from Tony DeBellis (2012)
Rain for Rent dewatering process water treatment system spent media disposal and replacement	cost is 125% of cost for mobilization for each medial replacement	Each	1	$93,750.00	$93,750	Oakley Rain for Rent Quote from Tony DeBellis (2012)
Treament System Operations	One operator	Day	88	$574.00	$50,512	2013 RSMeans Site Work and Landscape Cost Data One Equip. Oper. (med)
Characterization/Monitoring Sampling of Dewatering Process Water	Including pH, TDS, TSS, COD, Total Metals, PCBs. Assume one sample is needed every 10000 CF of processed water.	Each	46	$1,000.00	$46,000	Engineer's Estimate
				Subtotal:	**$335,700**	
Discharge of Dewatering Process Water to SFPUC						
Permit Fee		Each	1	$1,000.00	$1,000	Engineer's Estimate
Batch Discharge to SFPUC	Sewer service charge is per 100 cubic feet discharged. Only for Water from the decon activities	CF	4,503	$6.56	$29,539	2012 costs from the San Franciso Public Utilities Commission. Water price of $6.55 per 100 CF.
				Subtotal:	**$30,600**	
Capping						
Capping Material Transportation	Assume the amount of material needed is equal to the amount sediment removed. Assume material is 1.5 ton/CY based on data from the Geotechnical Study	Ton	14,909	$50.00	$745,425	Engineer's Estimate. Source of material has not been identified at this time.
Excavator for Installation of Cap material	Excavator, hydraulic, 2 CY bucket	LCY	9,939	$40.00	$397,560	Engineer's Estimate.
Add long reach boom/arm for excavator	add 50% of the excavator costs	LCY	9,939	$20.00	$198,780	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 23 16.42-4250
				Subtotal	**$1,341,800**	
Post Construction Costs						
Site Restoration for Access Roads	grading of access roads	Day	2	$1,266.02	$2,532	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. Crew B-10L - 0.5 laborer
Site Restoration for Staging Area	Plant-mix Asphalt Paving with wearing course 2.5" thick. Assume 2 acres will be disturbed	SY	9680	$12.55	$121,484	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 12 16.13-0420
Project Closeout	Phase II Investigation costs	Each	1	$25,000.00	$25,000	Engineer's Estimate
				Subtotal	**$149,100**	
				Capital Costs Subtotal:	$7,296,225	
				Adjusted Capital Cost Subtotal for San Francisco, CA Location Factor (123.4):	$9,003,600	
				10% Legal and Administrative Fees	$900,400	
				20% Contingencies:	$1,800,800	
				Predesign Investigations	$1,000,000	Engineer's Estimate
				Construction Management (10% of total capital cost)	$900,400	Engineer's Estimate
				Engineering Design 10 % of total capital cost	$900,400	Engineer's Estimate
				Total Capital Costs in 2013 Dollars:	**$14,506,000**	
Monitored Natural Attenuation						
MNR Costs		LS	1	$236,840.00	$236,840	MNR costs provided by Arcadis (2012)
				Annual Cost Subtotal:	$236,840	
				Adjusted Capital Cost Subtotal for San Francisco, CA Location Factor (123.4):	$292,261	
				10% Legal and Administrative Fees	$29,226	
				20% Contingencies:	$58,452	
				Total:	**$380,000**	
Periodic (5-year) Monitoring for 30 years						
Institutional Controls	Easement, fencing, signs	LS	1	$25,000	$25,000	Engineer's Estimate
Site Monitoring		LS	1	$20,000	$20,000	Engineer's Estimate
Reporting		LS	1	$10,000	$10,000	Engineer's Estimate
				5-Year Cost Subtotal:	$55,000	
				Adjusted Capital Cost Subtotal for San Francisco, CA Location Factor (123.4):	$67,870	
				10% Legal and Administrative Fees	$6,787	
				20% Contingencies:	$13,574	
				5-Year Total:	$88,231	
				30-Year Present Worth of 5-Year Costs:	**$246,000**	
				2013 Present Worth Cost:	**$15,132,000**	

Table G-9 Cost Estimate for Hydraulic Dredging for Alternative 5: Top 1 - foot removal where COCs exceed RGs, 2-foot removal in same areas where COCs exceed RGs, Engineered Cap, MNR
Yosemite Slough Site, San Francisco, CA

Item Description	Comment	Unit	Quantity	Unit Cost	Cost	Reference

Assumptions

1. Volume of Contaminated Material	9,939	BCY, as estimated using the polygon method, E&E, 2013	
2. Volume of Hazardous lead contaminated soil	3,000	BCY	
3. Perimeter around staging area	3000	ft	
4. Area available for Staging Area	13	acre	
5. Project Duration			
Mobilization	5	days	
Dewatering and Treatment system set up	5	days	
Dredging	34	days	Dredging rate is 300 CY/day. Assume 5 days per week
Capping	34	days	
Restoration	5	days	
Demobilization	5	days	
Total Project Duration	88	days	
6. Volume of water generated from staging area activities (the dewatering water treatment costs have been included in the vendor cost for dewatering activities)	215,000	CF	
7. In-Situ Bulk Density assumed for the project is	1.5	Tons/BCY	
8. Swell Factor was assumed to be	15%		

9. Assume access road preparation will disturb 1 acre and the staging area will disturb 1 acre for a total of 2 acres.
10. After construction activities are completed, the disturbed two acres will require pavement restoration.
11. The surveying crew will be needed for the entire project duration to compete a pre-excavation, post-excavation, and post capping surveys and to assist the excavation crew.
12. Two cofferdams will be installed to contain the flow during the hydraulic dredging activities. Assume that a silt curtain will be installed as part of this process.
13. Assume 10,000 gallons of water would be needed daily for decontamination purposes. Assume this water will be treated by the dewatering process water treatment facility.
14. One sample is needed every 10,000 CF of processed water.
15. The Suspended Solids, Oil/Grease and COD will be removed during the sediment dewatering process.
16. Assume that there is a manhole located onsite discharge of treated dewatering process water.
17. Assume there is a fire hydrant onsite for the supply of decontamination water.
18. Onsite material from access road creation will be used to fill in depressions created by debris removal.
19. Amount of backfill material needed for bank treatment is 1000' bank length x 50' width x 2' depth.
20. Assume 50 truck loads of debris will be removed from banks.
21. Present worth of costs assumes 5% annual interest rate.
22. Unit costs listed were obtained from 2012 RS Means Cost Data and engineering judgement.
23. Mobilization costs provided by the vendor includes three phases of mobilization. Phase I includes obtaining permits, constructing access roads, site prep, erosion/stormwater control fencing, safety signs etc and Turbidity curtains. All other measures such as monitoring processes and traffic regulations necessary will be put in place. Phase II will involve the installation of dewatering equipment and the launching of dredges as well as installation of dredge pipes. Phase III will include testing of equipment, surveying, work layout and staking of the pond. Set up of water and power will also be
24. Institutional Controls at the site are expected to include deed restrictions, informational signs and dissemination of information by the State Parks to the general public.

Key:
LF = Linear Foot
SY = Square Yard
BCY = Bank Cubic Yard
LCY = Loose Cubic Yard
LS = Lump Sum
SF = Square Feet
CF = Cubic Feet

Table G-10 Cost Estimate for Mechanical Dredging for Alternative 6: Remove sediments in the Top 2 - foot removal where COCs exceed RGs; Engineered Cap and ICs
Yosemite Slough Site, San Francisco, CA

Item Description	Comment	Unit	Quantity	Unit Cost	Cost	Reference
Capital Cost						
Institutional Controls		Each	1	$25,000.00	$25,000	Engineer's estimate
				Subtotal	**$25,000**	
Preconstruction/Site Preparation						
Surveying Crew	assume availability of the crew during mobilization/demobilization for pre- and post-construction surveys and during excavation/capping.	Day	88	$1,889.31	$166,259	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.Crew A-7
Cut and Chip Trees	Trees to 6" dia.; assume 1 acre for haul roads and one acre for staging areas	Acre	2	$4,625.00	$9,250	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.31 11 10.10-0020
Grub Stumps and Remove	Trees to 6" dia.; assume 1 acre for haul roads and one acre for staging areas	Acre	2	$2,050.00	$4,100	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 11 10.10-0150
Strip topsoil and Stockpile	200 HP Dozer, adverse conditions; Assume top 6" would be stripped and stockpiled for disposal	CY	1614	$0.98	$1,582	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.31 14 13.23 0020
Crushed Stone for establishing haul roads and staging areas	Assume 6" layer of Crushed Stone, spread with 200 HP Dozer, no compaction, 2 mi. RT haul	CY	1614	$42.00	$67,788	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 05 16.10 0300
Compaction	Riding, Vibrating Roller, 6" Lifts, 2 passes	CY	1614	$0.45	$726	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 23 23.23 5000
Grading	Grading subgrade for base course, roadways.	SY	9680	$0.20	$1,936	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 22 16.10 3300
Install Fence	Chain link industrial, 6' H, 6 gauge wire with 3 strands barb wire; around staging area	LF	3000	$30.00	$90,000	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.32 31 13.20-0500
Gate	Double swing gates, includes posts with 12' opening	Each	2	$1,100.00	$2,200	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.32 31 13.20-5060
Signs	Reflectorized 24"x 24" sign mounted to fence	Each	4	$130.00	$520	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.10 14 53.20-0100; increase by 50% for text customization
Office Trailer Rental	Office trailer, furnished, rent per month, 50' x 12' excl. hookups. + air conditioning. Assume 6 month rental	MO	6	$425.50	$2,553	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 52 13.20 0550
Office Trailer Delivery	Office trailer, delivery and pickup, assume 40 miles/round trip	MI	40	$11.65	$466	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 52 13.20 0800
Trailer Telephone	Field office expense - telephone bill; avg. bill/month, incl. long distance., Assume 6 month rental	MO	6	$89.00	$534	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 52 13.40 0140
Lights and HVAC	Field office expense - field office lights & HVAC., Assume 6 month rental	MO	6	$167.00	$1,002	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 52 13.40 0160
Sanitary Facilities	Rent toilet, portable, chemical, Assume 6 month rental	MO	6	$183.00	$1,098	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 54 33.40 6410 (Construciton Aids)
Three Phase power supply	Assume cost for setting up electrical service to operate equipment to be around $20,000	LS	1	$20,000.00	$20,000	Engineer's Estimate
Utility Cost during Project activities	Assume $15,000	LS	1	$15,000.00	$15,000	Engineer's Estimate
Bank Treatment Debris Removal	Cost for removing debris located along the Slough banks. Assume 1 Gradall, 3 ton, 1 CY, 1 Equipment Operator, 4 laborers	Day	5	$3,448.20	$17,241	2013 RSMeans Site Work and Landscape Cost Data Crew B-12 K + 3 laborers
Bank Treatment Transport Debris to Staging Area	Assume 50 truck loads of debris will be removed from banks. 8 C.Y. truck, 15 MPH ave, cycle 1 mile, 30 min wait/Ld./ Uld.	CY	400	$7.55	$3,020	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 23 23.20-0414
Transportation of Collected Debris	Debris removed for staging area/access road construction and other Debris. Dump truck transport from Yosemite Slough to Landfill; incl taxes and fees	Ton	3,021	$50.00	$151,050	Engineer's Estimate
Disposal of Collected Debris	Debris removed for staging area/access road construction and other Debris. Disposal at Landfill; incl taxes and fees	Ton	3,021	$50.00	$151,050	Engineer's Estimate
Bank Treatment Backfill	Assume 1-1/2" crushed stone will be used to fill in depressions that could potentially could form during excavation activities. Assume 500 CY of fill, includes cost for spreading, 2 mi RT Haul	LCY	500	$42.00	$21,000	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 05 16.10 0300
Erosion and Sediment Controls - Jute Mesh	Includes Jute Mesh 100 SY per roll, 4' wide, stapled	SY	9,680	$2.06	$19,941	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 25 14.16 0020
Erosion and Sediment Control - Silt Fence & Hay Bales	Includes Silt Fence, polypropylene, 3' high, adverse conditions & Hay Bales, staked	LF	3,000	$11.75	$35,250	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 25 14.16 1100 + 1250
				Subtotal	**$783,600**	
Health and Safety						
Health and Safety Plan	Prepare Site-specific health and safety plan as well as prepare community notification documents	Each	1	$10,000.00	$10,000	Engineer's Estimate
Construct Decontamination Pad & Containment	For equipment and personnel, Assume 4 setups will be needed.	Setups	4	$5,000.00	$20,000	Engineer's Estimate
Water Supply for Decontamination	Assume daily water need for decontamination process is 5,000 gallons/setup.	100	2,620	$5.10	$13,364	2012 costs from the San Francisco Public Utilities Commission. Water price of $5.10 per 100 CF.
Community/Exclusion Zone Air Monitoring	Particulate meter purchase (Qty 4)	Each	4	$7,200.00	$28,800	Industrial Environmental Monitoring Instruments, http://www.ierents.com/ as of January 2012
Site Safety Officer	10 hrs./day, 5days/wk., $100/hr.; 100% of project duration	manweeks	20	$5,000.00	$100,000	Engineer's Estimate
				Subtotal	**$172,200**	
Construction Mob/Demob						
Construction Oversight	10 hrs./day, 5days/wk., $100/hr.; 100% of project duration	manweeks	20	$5,000.00	$100,000	Engineer's Estimate
Pre-Construction Safety Meeting	Pre-Construction safety meeting for all equipment operators and other personnel on the job. Assume 20 people will attend for 8 hours at $125/hour	Each	20	$1,000.00	$20,000	Engineer's Estimate
Mobilization for Dry Excavation Equipment	Up to 25 mile haul distance; 3 loader, 1 forklift, 2 excav., 1 grader, 1 paver, and 2 Trucks above 150 H.P.,	Each	10	$505.00	$5,050	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.01 54 36.50-0100
Demobilization for Dry Excavation Equipment	Up to 25 mile haul distance; 3 loader, 1 forklift, 2 excav., 1 grader, 1 paver, and 2 Trucks above 150 H.P.,	Each	10	$505.00	$5,050	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.01 54 36.50-0100
				Subtotal	**$130,100**	
Hydraulic/Turbidity Controls						
Hydraulic/Turbidity Controls	Assume uniform $1,000,000 placeholder for all alternatives	LS	1	$1,000,000	$1,000,000	Engineer's Estimate
				Subtotal	**$1,000,000**	

Table G-10 Cost Estimate for Mechanical Dredging for Alternative 6: Remove sediments in the Top 2 - foot removal where COCs exceed RGs; Engineered Cap and ICs
Yosemite Slough Site, San Francisco, CA

Item Description	Comment	Unit	Quantity	Unit Cost	Cost	Reference
Contaminated Sediment Removal (Sediment Excavation, Transport, and Stockpiling)						
Timber Crane Mats for Slough Access	Cost for timber mat material. Assume the Yosemite Slough width is 300 ft., the number of pieces of Mat needed to cross the Slough is: 300 ft./4ft =75. Assume 200 mats needed for the entire project.	Each	200	$785.00	$157,000	The Mat Source: http://www.thematsource.com/mat-inventory/timber-mats.html. Douglas Fir Crane Mats (12 in *4 ft. * 20 ft.), each mat consists of 4 timbers. Accessed in June 2012.
Timber Crane Mats Relocation	Backhoe Loader, 80 HP, 1 equipment operator and 2 laborers. For adjusting and relocating timber mats as needed during the project duration	Day	83	$1,888.04	$156,707	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. Crew B-11 M plus one additional laborer
Excavation of Sediment	Excavator, hydraulic, 2 CY bucket = 165 CY/hr.	BCY	25,349	$45.00	$1,140,705	Engineer's Estimate
Loading sediment onto trucks	add 15% to excavation costs	BCY	25,349	$6.75	$171,106	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 23 16.42-0020
Add long reach boom/arm for excavator	add 50% of the excavator costs	BCY	25,349	$22.50	$570,353	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 23 16.42-4250
Transport Sediment to Stockpile (staging area)	8 C.Y. truck, 15 MPH ave, cycle 1 mile, 30 min wait/Ld./ Uld.	LCY	29,151	$7.55	$220,093	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 23 23.20-0414
Stockpiling of Dredged Sediment	1 F.E. Loaders, Wheel Mounted, 2.5 CY capacity, 1 operator and laborer, available onsite full time during excavation, capping, restoration and demobilization activities.	Day	88	$1,371.22	$120,667	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. Crew B-10T
Sediment Dewatering	including debris removal, generator, shakers, belt press, and polymer dosage. Assumed Dewatering for mechanical and hydraulic dredging activities are equal.	LCY	29,151	$63.00	$1,836,535	2012 Vendor quote provided by JND Thomas Co., Inc. provided for Hydraulic dredging.
				Subtotal	**$4,373,200**	
Sediment Stabilization for Lead						
Sediment Stabilization	EnviroBlend CS, 1-3% wt./wt. dosage, 2000 # Supersacks, material only	Ton	225	$285.00	$64,125	2012 Vendor Quote from Premier Chemicals LLC.
Transportation Costs	Freight Costs, $1,300/22 sacks	Ton	225	$59.09	$13,295	2012 Vendor Quote from Premier Chemicals LLC.
ForkLift Rental	Assume Forklift rental for one day when the material would be delivered onsite	Day	1	$1,117.24	$1,117	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.Crew A-3P
Mixing Sediment with the product	Front End Loader, 5 CY bucket	LCY	5,750	$1.94	$11,155	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 312316.42-1350
Characterization Sampling of Treated Sediment	Assume 1 sample required per 100 LCY. Includes TCLP, STLC, TTLC testsmetals and PCBs	Each	58	$1,000.00	$58,000	Engineer's Estimate
				Subtotal	**$147,700**	
Transportation and Disposal of Non-hazardous sediment						
Characterization Sampling of Dewatered Sediment	Assume 1 sample required per 500 LCY. Includes analysis for metals and PCBs	Each	59	$1,000.00	$59,000	Engineer's Estimate
Loading Sediment onto Trucks	Front End Loader, 5 CY bucket, Assumed Loading will occur during the excavation and capping activites.	Day	78	$1,954.00	$152,412	2012 RSMeans Site Work and Landscape Cost Data 31st Ed. Crew B-10U
Transportation	Dump truck transport from Yosemite Slough to Landfill; incl taxes and fees	Ton	38,024	$50.00	$1,901,175	Engineer's Estimate
Disposal	Disposal at Landfill; incl taxes and fees	Ton	38,024	$50.00	$1,901,175	Engineer's Estimate
				Subtotal	**$4,013,800**	
Treatment of Dewatering Process Water						
FRAC Tank Rental; for "holding tank" of water	6 x 21,000 Tank with Cleaning	Day	98	$1,200.00	$117,600	Engineer's Estimate
Rain for Rent dewatering process water treatment system mobilization	process involves a settling tank, sand filtration, bag filter, carbon filter, resins/Organoclay, holding tank for testing	Each	1	$75,000.00	$75,000	Oakley Rain for Rent Quote from Tony DeBellis (2012)
Rain for Rent dewatering process water treatment system spent media disposal and replacement	cost is 125% of cost for mobilization for each media replacement	Each	1	$93,750.00	$93,750	Oakley Rain for Rent Quote from Tony DeBellis (2012)
Treament System Operations	One operator	Day	98	$574.00	$56,252	2013 RSMeans Site Work and Landscape Cost Data One Equip. Oper. (med)
Characterization/Monitoring Sampling of Dewatering Process Water	Including pH, TDS, TSS, COD, Metals, PCBs. Assume one sample is needed every 10000 CF of processed water.	Each	132	$1,000.00	$132,000	Engineer's Estimate
				Subtotal	**$474,700**	
Discharge of Dewatering Process Water to SFPUC						
Permit Fee		Each	1	$1,000.00	$1,000	Engineer's Estimate
Batch Discharge to SFPUC	Sewer service charge is per 100 cubic feet discharged	100 CF	13,144	$6.56	$86,226	2012 costs from the San Franciso Public Utilities Commission. Water price of $6.55 per 100 CF.
				Subtotal	**$87,300**	
Capping						
Capping Material Transportation	Assume the amount of material needed is equal to the amount sediment removed. Assume material is 1.5 ton/CY based on data from the Geotechnical Study	Ton	38,024	$50.00	$1,901,175	Engineer's Estimate. Source of material has not been identified at this time.
Excavator for Installation of Cap material	Excavator, hydraulic, 2 CY bucket	LCY	29,151	$40.00	$1,166,054	Engineer's Estimate.
Add long reach boom/arm for excavator	add 50% of the excavator costs	LCY	29,151	$20.00	$583,027	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 23 16.42-4250
				Subtotal	**$3,650,300**	
Post Construction Costs						
Site Restoration for Staging Area/Access Roads	grading of access roads and staging area for paving	Day	2	$1,211.86	$2,424	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. Crew B-10L - 0.5 laborer
Site Restoration for Access road/staging area	Plant-mix Asphalt Paving with binder course 2.5" thick.	SY	9680	$11.30	$109,384	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 32 12 16.13-0130
Site Restoration for Staging Area	Plant-mix Asphalt Paving with wearing course 2.5" thick.	SY	9680	$12.55	$121,484	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 32 12 16.13-0420
Project Closeout	Phase II Investigation costs	Each	1	$25,000.00	$25,000	Engineer's Estimate
				Subtotal	**$258,300**	
				Capital Costs Subtotal:	$15,116,200	
				Adjusted Capital Cost Subtotal for San Francisco, CA Location Factor (123.4):	$18,653,400	
				10% Legal and Administrative Fees	$1,865,400	
				20% Contingencies:	$3,730,700	
				Predesign Investigations	$1,000,000	Engineer's Estimate
				Construction Management (10% of total capital cost)	$1,865,400	Engineer's Estimate
				Engineering Design (10 % of total capital cost)	$1,865,400	Engineer's Estimate
				Total Capital Costs in 2013 Dollars:	**$28,981,000**	
Annual Costs						
				Annual Cost Subtotal:	$0	
				Adjusted Capital Cost Subtotal for San Francisco, CA Location Factor (123.4):	$0	
				10% Legal and Administrative Fees	$0	
				20% Contingencies:	$0	
				Annual Total:	$0	
				30-Year Present Worth of Annual Monitoring Costs:	**$0**	

Table G-10 Cost Estimate for Mechanical Dredging for Alternative 6: Remove sediments in the Top 2 - foot removal where COCs exceed RGs; Engineered Cap and ICs
Yosemite Slough Site, San Francisco, CA

Item Description	Comment	Unit	Quantity	Unit Cost	Cost	Reference
Periodic (5-year) Monitoring for 30 years						
Institutional Controls	Easement, fencing, signs	LS	1	$25,000	$25,000	Engineer's Estimate
Site Monitoring		LS	1	$20,000	$20,000	Engineer's Estimate
Reporting		LS	1	$10,000	$10,000	Engineer's Estimate
				5-Year Cost Subtotal:	$55,000	
		Adjusted Capital Cost Subtotal for San Francisco, CA Location Factor (123.4):			$67,870	
		10% Legal and Administrative Fees			$6,787	
				20% Contingencies:	$13,574	
				5-Year Total:	$88,231	
		30-Year Present Worth of Periodic Monitoring Costs:			**$246,000**	
				2013 Present Worth Cost:	**$29,227,000**	

Assumptions

1. Volume of Contaminated Material (Total) — 25,349 BCY, as estimated using the polygon method, E&E, 2013
2. Volume of Hazardous lead contaminated soil — 5,000 BCY
3. Perimeter around staging area — 3000 ft
4. Area available for Staging Area — 13 acre
5. Project Duration
   - Mobilization — 5 days
   - Dewatering and Treatment system set up — 5 days
   - Excavation — 39 days
   - Capping — 39 days
   - Restoration — 5 days
   - Demobilization — 5 days
   - Total Project Duration — 98 days

   Total volume removed/excavation rate of 165 CY/HR. Assume 8 hours per day, 5 days per week, Assume 50% production rate.
6. Dewatering
   - Volume of water from the sediment (assume that the sediment will only have 30% water, as dewatering activities would have removed most of the water) — 205326.9 CF
   - Volume of water that would be pumped during dewatering (assume 50 gpm, 24 hours a day during dewatering setup, excavation, capping and restoration) — 847,059 CF
7. In-Situ Bulk Density assumed for the project is — 1.5 Tons/BCY
8. Swell Factor was assumed to be — 15%
9. Assume access road preparation will disturb 1 acre and the staging area will disturb 1 acre for a total of 2 acres.
10. After construction activities are completed, the disturbed two acres will require pavement restoration.
11. The surveying crew will be needed for the entire project duration to compete a pre-excavation, post-excavation, and post capping surveys and to assist the excavation crew.
12. The cofferdam needed is 1000' (length) by 36' (depth). Assume that a silt curtain will be in place during the installation and removal of the cofferdam.
13. Assume 5000 gallons of water/decon setup would be needed daily for decontamination purposes. Assume this water will be treated by the dewatering process water treatment facility.
14. Approximately 200 timber crane mats will be needed for the entire project.
15. One sample is needed every 10,000 CF of processed water.
16. The Suspended Solids, Oil/Grease and COD will be removed during the sediment dewatering process.
17. Assume that there is a manhole located onsite discharge of treated dewatering process water.
18. Assume there is a fire hydrant onsite for the supply of decontamination water.
19. Onsite material from access road creation will be used to fill in depressions created by debris removal.
20. Amount of backfill material needed for bank treatment is 1000' bank length x 50' width x 2' depth.
21. Assume 10 truck loads of debris will be removed from banks.
22. Present worth of costs assumes 5% annual interest rate.
23. Unit costs listed were obtained from 2012 RS Means Cost Data and engineering judgement.
24. Institutional Controls at the site are expected to include deed restrictions, informational signs and dissemination of information by the State Parks to the general public.

Key:
LF = Linear Foot
SY = Square Yard
BCY = Bank Cubic Yard
LCY = Loose Cubic Yard
LS = Lump Sum
SF = Square Feet
CF = Cubic Feet

Table G-11 Cost Estimate for Hydraulic Dredging for Alternative 6: Remove sediments in the Top 2 - foot removal where COCs exceed RGs; Engineered Cap and ICs
Yosemite Slough Site, San Francisco, CA

Item Description	Comment	Unit	Quantity	Unit Cost	Cost	Reference
Capital Cost						
Institutional Controls		Each	1	$25,000.00	$25,000	Engineer's estimate
				Subtotal:	**$25,000**	
Preconstruction/Site Preparation						
Site Preparation, access road construction, site survey, mobilization and demobilization of equipment	Includes construction of 8" HDPE pipe for sediment transport to staging area, and launching of the dredge, See assumptions below for additional details on what is included in the mobilization costs	LS	1	$400,000.00	$400,000	Quote from JND Thomas Co, Inc.
Install Fence	Chain link industrial, 6' H, 6 gauge wire with 3 strands barb wire; around staging area	LF	3000	$30.00	$90,000	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 32 31 13.20-0500
Gate	Double swing gates, includes posts with 12' opening	Each	2	$1,100.00	$2,200	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 32 31 13.20-5060
Signs	Reflectorized 24"x 24" sign mounted to fence	Each	4	$130.00	$520	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 10 14 53.20-0100; increase by 50% for text customization
Office Trailer Rental	Office trailer, furnished, rent per month, 50' x 12' excl. hookups. + air conditioning. Assume 6 month rental	MO	6	$425.50	$2,553	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 52 13.20 0550
Office Trailer Delivery	Office trailer, delivery and pickup, assume 40 miles/round trip	MI	40	$11.65	$466	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 52 13.20 0800
Trailer Telephone	Field office expense - telephone bill; avg. bill/month, incl. long distance., Assume 6 month rental	MO	6	$89.00	$534	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 52 13.40 0140
Lights and HVAC	Field office expense - field office lights & HVAC., Assume 6 month rental	MO	6	$167.00	$1,002	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 52 13.40 0160
Sanitary Facilities	Rent toilet, portable, chemical, Assume 6 month rental	MO	6	$183.00	$1,098	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 54 33.40 6410 (Construciton Aids)
Three Phase power supply	Assume cost for setting up electrical service to operate equipment to be around $20,000	LS	1	$20,000.00	$20,000	Engineer's Estimate
Utility Cost during Project activities	Assume $15,000	LS	1	$15,000.00	$15,000	Engineer's Estimate
Bank Treatment Debris Removal	Cost for removing debris located along the Slough banks. Assume 1 Gradall, 3 ton, 1 CY, 1 Equipment Operator, 4 laborers	Day	5	$3,448.20	$17,241	2013 RSMeans Site Work and Landscape Cost Data Crew B-12 K + 3 laborers
Bank Treatment Transport Debris to Staging Area	Assume 50 truck loads of debris will be removed from banks. 8 C.Y. truck, 15 MPH ave, cycle 1 mile, 30 min wait/Ld./ Uld.	LCY	400	$7.55	$3,020	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 23 23.20-0414
Transportation of Collected Debris	Debris removed for staging area/access road construction and other Debris. Dump truck transport from Yosemite Slough to Landfill; incl taxes and fees	Ton	600	$50.00	$30,000	Engineer's Estimate
Disposal of Collected Debris	Debris removed for staging area/access road construction and other Debris. Disposal at Landfill; incl taxes and fees	Ton	600	$50.00	$30,000	Engineer's Estimate
Bank Treatment Backfill	Assume 1-1/2" crushed stone will be used to fill in depressions that could potentially could form during excavation activities. Assume 500 CY of fill, includes cost for spreading, 2 mi RT Haul	LCY	500	$42.00	$21,000	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 05 16.10 0300
Erosion and Sediment Controls - Jute Mesh	Includes Jute Mesh 100 SY per roll, 4' wide, stapled, 2 acres	SY	9,680	$2.06	$19,941	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.31 25 14.16 0020
Erosion and Sediment Control - Silt Fence & Hay Bales	Includes Silt Fence, polypropylene, 3' high, adverse conditions & Hay Bales, staked	LF	3,000	$11.75	$35,250	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 25 14.16 1100 + 1250
				Subtotal:	**$689,825**	
Health and Safety						
Health and Safety Plan	Prepare Site-specific health and safety plan as well as prepare community notification documents	Each	1	$10,000.00	$10,000	Engineer's Estimate
Construct Decontamination Pad & Containment	For equipment and personnel, Assume 4 setups will be needed.	Setups	4	$5,000.00	$20,000	Engineer's Estimate
Water Supply for Decontamination phases	Assume daily water need for decontamination process is 5,000 gallons/setup.	CF	2,540	$5.10	$12,955	2012 costs from the San Francisco Public Utilities Commission. Water price of $5.10 per 100 CF.
Community/Exclusion Zone Air Monitoring	Particulate meter purchase (Qty 4)	Each	4	$7,200.00	$28,800	Industrial Environmental Monitoring Instruments, http://www.ierents.com/ as of January 2012
Site Safety Officer	10 hrs/day, 5days/wk, $100/hr; 100% of project duration	manweeks	38	$5,000.00	$190,000	Engineer's Estimate
				Subtotal:	**$261,800**	
Construction Costs						
Construction Oversight	10 hrs/day, 5days/wk, $100/hr; 100% of project duration	manweeks	38	$5,000.00	$190,000	Engineer's Estimate
Pre-Construction Safety Meeting	Pre-Construction safety meeting for all equipment operators and other personnel on the job. Assume 20 people will attend for 8 hours at $125/hour	Each	20	$1,000.00	$20,000	Engineer's Estimate
				Subtotal:	**$210,000**	
Hydraulic/Turbidity Controls						
Hydraulic/Turbidity Controls	Assume uniform $1,000,000 placeholder for all alternatives	LS	1	$1,000,000	$1,000,000	Engineer's Estimate
				Subtotal:	**$1,000,000**	
Contaminated Sediment Removal (Hydraulic Dredging)						
Sediment removal and pumping to sediment dewatering plant at site access area through an 8" HDPE pipeline	using the Moray 8" Swinging Ladder Dredge	BCY	25,349	$63.00	$1,596,987	Vendor quote from JND Thomas Co., Inc.
Cofferdam Construction and Removal	Based on supply and installation of cofferdam	LS	1	$410,000.00	$410,000	Vendor quote from JND Thomas Co., Inc.
				Subtotal:	**$2,007,000**	
Sediment Dewatering and Characterization						
Mechanical Dewatering System and Dewatered Sediment Stockpiling	The dewatering system is expected to include Two Dual Tandem Shakers, Two Mix tanks, 4 14" Hydro-cyclones, Hydro-clear HC2500 Clarifier, Three belt presses, polymer dosage and additional storage tank prior to disposal to the slough. Flow is expected to be around 2000 gpm. Includes costs for Characterization and monitoring costs	LCY	29,151	$63.00	$1,836,535	Vendor quote from JND Thomas Co., Inc.
				Subtotal:	**$1,836,600**	

Table G-11 Cost Estimate for Hydraulic Dredging for Alternative 6: Remove sediments in the Top 2 - foot removal where COCs exceed RGs; Engineered Cap and ICs
Yosemite Slough Site, San Francisco, CA

Item Description	Comment	Unit	Quantity	Unit Cost	Cost	Reference
Sediment Stabilization for Lead						
Sediment Stabilization	EnviroBlend CS, 1-3% wt./wt. dosage, 2000 # Supersacks, material only	Ton	225	$285.00	$64,125	2012 Vendor Quote from Premier Chemicals LLC.
Transportation Costs	Freight Costs, $1,300/22 sacks	Ton	225	$59.09	$13,295	2012 Vendor Quote from Premier Chemicals LLC.
ForkLift Rental	Assume Forklift rental for one day when the material would be delivered onsite	Day	1	$1,117.24	$1,117	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. Crew A-3P
Mixing Sediment with the product	Front End Loader, 5 CY bucket	LCY	5,750	$1.94	$11,155	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 312316.42-1350
Characterization Sampling of Treated Sediment	Assume 1 sample required per 100 LCY. Includes TCLP, STLC, TTLC testsmetals and PCBs	Each	58	$1,000.00	$58,000	Engineer's Estimate
				Subtotal:	**$147,700**	
Transportation and Disposal of Non-hazardous sediment						
Characterization Sampling of Dewatered Sediment	Assume 1 sample required per 500 LCY. Includes analysis for total metals and PCBs, TCLP, hexavelent chromium, paint filter test	Each	59	$1,000.00	$59,000	
Loading Sediment onto Trucks	Front End Loader, 5 CY bucket, Assumed Loading will occur during the excavation and capping activites.	Day	170	$1,954.00	$332,180	2012 RSMeans Site Work and Landscape Cost Data 31st Ed. Crew B-10U
Transportation	Dump truck transport from Yosemite Slough to Landfill; incl taxes and fees	Ton	38,024	$50.00	$1,901,175	Engineer's Estimate
Disposal	Disposal at Landfill; incl taxes and fees	Ton	38,024	$50.00	$1,901,175	Engineer's Estimate
				Subtotal:	**$4,193,600**	
Treatment of Decontamination Process Water						
FRAC Tank Rental; for "holding tank" of water	4 x 21,000 Tank with Cleaning	Day	190	$800.00	$152,000	Engineer's Estimate
Rain for Rent dewatering process water treatment system mobilization	process involves a settling tank, sand filtration, bag filter, carbon filter, resins/Organoclay, holding tank for testing	Each	1	$75,000.00	$75,000	Oakley Rain for Rent Quote from Tony DeBellis (2012)
Rain for Rent dewatering process water treatment system spent media disposal and replacement	cost is 125% of cost for mobilization for each medial replacement	Each	1	$93,750.00	$93,750	Oakley Rain for Rent Quote from Tony DeBellis (2012)
Treament System Operations	One operator	Day	190	$574.00	$109,060	2013 RSMeans Site Work and Landscape Cost Data One Equip. Oper. (med)
Characterization/Monitoring Sampling of Dewatering Process Water	Including pH, TDS, TSS, COD, Total Metals, PCBs. Assume one sample is needed every 10000 CF of processed water.	Each	81	$1,000.00	$81,000	Engineer's Estimate
				Subtotal:	**$510,900**	
Discharge of Dewatering Process Water to SFPUC						
Permit Fee		Each	1	$1,000.00	$1,000	Engineer's Estimate
Batch Discharge to SFPUC	Sewer service charge is per 100 cubic feet discharged. Only for Water from the decon activities	CF	8,020	$6.56	$52,612	2012 costs from the San Franciso Public Utilities Commission. Water price of $6.55 per 100 CF.
				Subtotal:	**$53,700**	
Capping						
Capping Material Transportation	Assume the amount of material needed is equal to the amount sediment removed. Assume material is 1.5 ton/CY based on data from the Geotechnical Study	Ton	38,024	$50.00	$1,901,175	Engineer's Estimate. Source of material has not been identified at this time.
Excavator for Installation of backfill material	Excavator, hydraulic, 2 CY bucket	LCY	29,151	$40.00	$1,166,054	Engineer's Estimate.
Add long reach boom/arm for excavator	add 50% of the excavator costs	LCY	29,151	$20.00	$583,027	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.31 23 16.42-4250
				Subtotal	**$3,650,300**	
Post Construction Costs						
Site Restoration for Access Roads	grading of access roads	Day	2	$1,266.02	$2,532	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. Crew B-10L - 0.5 laborer
Site Restoration for Staging Area	Plant-mix Asphalt Paving with wearing course 2.5" thick. Assume 2 acres will be disturbed	SY	9680	$12.55	$121,484	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 12 16.13-0420
Project Closeout	Phase II Investigation costs	Each	1	$25,000.00	$25,000	Engineer's Estimate
				Subtotal	**$124,100**	
				Capital Costs Subtotal:	$14,710,525	
				Adjusted Capital Cost Subtotal for San Francisco, CA Location Factor (123.4):	$18,152,800	
				10% Legal and Administrative Fees	$1,815,300	
				20% Contingencies:	$3,630,600	
				Predesign Investigations	$1,000,000	Engineer's Estimate
				Construction Management (10% of total capital cost)	$1,815,300	Engineer's Estimate
				Engineering Design 10 % of total capital cost	$1,815,300	Engineer's Estimate
				Total Capital Costs in 2013 Dollars:	**$28,230,000**	
Annual Costs						
				Annual Cost Subtotal:	$0	
				Adjusted Capital Cost Subtotal for San Francisco, CA Location Factor (123.4):	$0	
				10% Legal and Administrative Fees	$0	
				20% Contingencies:	$0	
				Annual Total:	$0	
				30-Year Present Worth of Annual Monitoring Costs:	**$0**	
Periodic (5-year) Monitoring for 30 years						
Institutional Controls	Easement, fencing, signs	LS	1	$25,000	$25,000	Engineer's Estimate
Site Monitoring		LS	1	$20,000	$20,000	Engineer's Estimate
Reporting		LS	1	$10,000	$10,000	Engineer's Estimate
				5-Year Cost Subtotal:	$55,000	
				Adjusted Capital Cost Subtotal for San Francisco, CA Location Factor (123.4):	$67,870	
				10% Legal and Administrative Fees	$6,787	
				20% Contingencies:	$13,574	
				5-Year Total:	$88,231	
				30-Year Present Worth of 5-Year Costs:	**$246,000**	
				2013 Present Worth Cost:	**$28,476,000**	

Table G-11 Cost Estimate for Hydraulic Dredging for Alternative 6: Remove sediments in the Top 2 - foot removal where COCs exceed RGs; Engineered Cap and ICs
Yosemite Slough Site, San Francisco, CA

Item Description	Comment	Unit	Quantity	Unit Cost	Cost	Reference
Assumptions						
1. Volume of Contaminated Material	25,349	BCY, as estimated using the polygon method, E&E, 2013				
2. Volume of Hazardous lead contaminated soil	5,000	BCY				
3. Perimeter around staging area	3000	ft				
4. Area available for Staging Area	13	acre				
5. Project Duration						
Mobilization	5	days				
Dewatering and Treatment system set up	5	days				
Dredging	85	days	Dredging rate is 300 CY/day. Assume 5 days per week			
Capping	85	days				
Restoration	5	days				
Demobilization	5	days				
Total Project Duration	190	days				
6. Volume of water generated from staging area activities (the dewatering water treatment costs have been included in the vendor cost for dewatering activities)	548,000	CF				
7. In-Situ Bulk Density assumed for the project is	1.5	Tons/BCY				
8. Swell Factor was assumed to be	15%					

9. Assume access road preparation will disturb 1 acre and the staging area will disturb 1 acre for a total of 2 acres.
10. After construction activities are completed, the disturbed two acres will require pavement restoration.
11. The surveying crew will be needed for the entire project duration to compete a pre-excavation, post-excavation, and post capping surveys and to assist the excavation crew.
12. Two cofferdams will be installed to contain the flow during the hydraulic dredging activities. Assume that a silt curtain will be installed as part of this process.
13. Assume 10,000 gallons of water would be needed daily for decontamination purposes. Assume this water will be treated by the dewatering process water treatment facility.
14. One sample is needed every 10,000 CF of processed water.
15. The Suspended Solids, Oil/Grease and COD will be removed during the sediment dewatering process.
16. Assume that there is a manhole located onsite discharge of treated dewatering process water.
17. Assume there is a fire hydrant onsite for the supply of decontamination water.
18. Onsite material from access road creation will be used to fill in depressions created by debris removal.
19. Amount of backfill material needed for bank treatment is 1000' bank length x 50' width x 2' depth.
20. Assume 50 truck loads of debris will be removed from banks.
21. Present worth of costs assumes 5% annual interest rate.
22. Unit costs listed were obtained from 2012 RS Means Cost Data and engineering judgement.
23. Mobilization costs provided by the vendor includes three phases of mobilization. Phase I includes obtaining permits, constructing access roads, site prep, erosion/stormwater control fencing, safety signs etc and Turbidity curtains. All other measures such as monitoring processes and traffic regulations necessary will be put in place. Phase II will involve the installation of dewatering equipment and the launching of dredges as well as installation of dredge pipes. Phase III will include testing of equipment, surveying, work layout and staking of the pond. Set up of water and power will also be
24. Institutional Controls at the site are expected to include deed restrictions, informational signs and dissemination of information by the State Parks to the general public.

Key:
LF = Linear Foot
SY = Square Yard
BCY = Bank Cubic Yard
LCY = Loose Cubic Yard
LS = Lump Sum
SF = Square Feet
CF = Cubic Feet

Table G-12 Cost Estimate for Mechanical Dredging for Alternative 7: Full removal where COCs exceed RGs (up to 4 feet) and Backfill
Yosemite Slough Site, San Francisco, CA

Item Description	Comment	Unit	Quantity	Unit Cost	Cost	Reference
Capital Cost						
Institutional Controls		Each	1	$25,000.00	$25,000	Engineer's estimate
				Subtotal:	**$25,000**	
Preconstruction/Site Preparation						
Surveying Crew	assume availability of the crew during mobilization/demobilization for pre- and post-construction surveys and during excavation/capping.	Day	134	$1,889.31	$253,168	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.Crew A-7
Cut and Chip Trees	Trees to 6" dia.; assume 1 acre for haul roads and one acre for staging areas	Acre	2	$4,625.00	$9,250	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.31 11 10.10-0020
Grub Stumps and Remove	Trees to 6" dia.; assume 1 acre for haul roads and one acre for staging areas	Acre	2	$2,050.00	$4,100	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 11 10.10-0150
Strip topsoil and Stockpile	200 HP Dozer, adverse conditions; Assume top 6" would be stripped and stockpiled for disposal	CY	1614	$0.98	$1,582	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 14 13.23 0020
Crushed Stone for establishing haul roads and staging areas	Assume 6" layer of Crushed Stone, spread with 200 HP Dozer, no compaction, 2 mi. RT haul	CY	1614	$42.00	$67,788	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 05 16.10 0300
Compaction	Riding, Vibrating Roller, 6" Lifts, 2 passes	CY	1614	$0.45	$726	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.31 23 23.23 5000
Grading	Grading subgrade for base course, roadways.	SY	9680	$0.20	$1,936	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.31 22 16.10 3300
Install Fence	Chain link industrial, 6' H, 6 gauge wire with 3 strands barb wire; around staging area	LF	3000	$30.00	$90,000	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.32 31 13.20-0500
Gate	Double swing gates, includes posts with 12' opening	Each	2	$1,100.00	$2,200	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 32 31 13.20-5060
Signs	Reflectorized 24"x 24" sign mounted to fence	Each	4	$130.00	$520	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.10 14 53.20-0100; increase by 50% for text customization
Office Trailer Rental	Office trailer, furnished, rent per month, 50' x 12' excl. hookups. + air conditioning. Assume 6 month rental	MO	6	$425.50	$2,553	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.01 52 13.20 0550
Office Trailer Delivery	Office trailer, delivery and pickup, assume 40 miles/round trip	MI	40	$11.65	$466	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 52 13.20 0800
Trailer Telephone	Field office expense - telephone bill; avg. bill/month, incl. long distance., Assume 6 month rental	MO	6	$89.00	$534	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 52 13.40 0140
Lights and HVAC	Field office expense - field office lights & HVAC., Assume 6 month rental	MO	6	$167.00	$1,002	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.01 52 13.40 0160
Sanitary Facilities	Rent toilet, portable, chemical, Assume 6 month rental	MO	6	$183.00	$1,098	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 54 33.40 6410 (Construciton Aids)
Three Phase power supply	Assume cost for setting up electrical service to operate equipment to be around $20,000	LS	1	$20,000.00	$20,000	Engineer's Estimate
Utility Cost during Project activities	Assume $15,000	LS	1	$15,000.00	$15,000	Engineer's Estimate
Bank Treatment Debris Removal	Cost for removing debris located along the Slough banks. Assume 1 Gradall, 3 ton, 1 CY, 1 Equipment Operator, 4 laborers	Day	5	$3,448.20	$17,241	2013 RSMeans Site Work and Landscape Cost Data Crew B-12 K + 3 laborers
Bank Treatment Transport Debris to Staging Area	Assume 50 truck loads of debris will be removed from banks. 8 C.Y. truck, 15 MPH ave, cycle 1 mile, 30 min wait/Ld./ Uld.	CY	400	$7.55	$3,020	2012 RSMeans Site Work and Landscape Cost Data 31st Ed. 31 23 23.20-0414
Transportation of Collected Debris	Debris removed for staging area/access road construction and other Debris. Dump truck transport from Yosemite Slough to Landfill; incl taxes and fees	Ton	3,021	$50.00	$151,050	Engineer's Estimate
Disposal of Collected Debris	Debris removed for staging area/access road construction and other Debris. Disposal at Landfill; incl taxes and fees	Ton	3,021	$50.00	$151,050	Engineer's Estimate
Bank Treatment Backfill	Assume 1-1/2" crushed stone will be used to fill in depressions that could potentially could form during excavation activities. Assume 500 CY of fill, includes cost for spreading, 2 mi RT Haul	LCY	500	$42.00	$21,000	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 05 16.10 0300
Erosion and Sediment Controls - Jute Mesh	Includes Jute Mesh 100 SY per roll, 4' wide, stapled	SY	9,680	$2.06	$19,941	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 25 14.16 0020
Erosion and Sediment Control - Silt Fence & Hay Bales	Includes Silt Fence, polypropylene, 3' high, adverse conditions & Hay Bales, staked	LF	3,000	$11.75	$35,250	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.31 25 14.16 1100 + 1250
				Subtotal	**$870,500**	
Health and Safety						
Health and Safety Plan	Prepare Site-specific health and safety plan as well as prepare community notification documents	Each	1	$10,000.00	$10,000	Engineer's Estimate
Construct Decontamination Pad & Containment	For equipment and personnel, Assume 4 setups will be needed.	Setups	4	$3,500.00	$14,000	Engineer's Estimate
Water Supply for Decontamination	Assume daily water need for decontamination process is 5,000 gallons/setup.	CF	3,850	$5.10	$19,636	2012 costs from the San Francisco Public Utilities Commission. Water price of $5.10 per 100 CF.
Community/Exclusion Zone Air Monitoring	Particulate meter purchase (Qty 4)	Each	4	$7,200.00	$28,800	Industrial Environmental Monitoring Instruments, http://www.ierents.com/ as of January 2012
Site Safety Officer	10 hrs./day, 5days/wk., $100/hr.; 100% of project duration	manweeks	29	$5,000.00	$145,000	Engineer's Estimate
				Subtotal	**$217,500**	
Construction Mob/Demob						
Construction Oversight	10 hrs./day, 5days/wk., $100/hr.; 100% of project duration	manweeks	29	$5,000.00	$145,000	Engineer's Estimate
Pre-Construction Safety Meeting	Pre-Construction safety meeting for all equipment operators and other personnel on the job. Assume 20 people will attend for 8 hours at $125/hour	Each	20	$1,000.00	$20,000	Engineer's Estimate
Mobilization for Dry Excavation Equipment	Up to 25 mile haul distance; 3 loader, 1 forklift, 2 excav., 1 grader, 1 paver, and 2 Trucks above 150 H.P.,	Each	10	$505.00	$5,050	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 54 36.50-0100
Demobilization for Dry Excavation Equipment	Up to 25 mile haul distance; 3 loader, 1 forklift, 2 excav., 1 grader, 1 paver, and 2 Trucks above 150 H.P.,	Each	10	$505.00	$5,050	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 54 36.50-0100
				Subtotal	**$175,100**	
Hydraulic/Turbidity Controls						
Hydraulic/Turbidity Controls	Assume uniform $1,000,000 placeholder for all alternatives	LS	1	$1,000,000	$1,000,000	Engineer's Estimate
				Subtotal	**$1,000,000**	

Table G-12 Cost Estimate for Mechanical Dredging for Alternative 7: Full removal where COCs exceed RGs (up to 4 feet) and Backfill
Yosemite Slough Site, San Francisco, CA

Item Description	Comment	Unit	Quantity	Unit Cost	Cost	Reference
Contaminated Sediment Removal (Sediment Excavation, Transport, and Stockpiling)						
Timber Crane Mats for Slough Access	Cost for timber mat material. Assume the Yosemite Slough width is 300 ft., the number of pieces of Mat needed to cross the Slough is: 300 ft./4ft =75. Assume 200 mats needed for the entire project.	Each	200	$785.00	$157,000	The Mat Source: http://www.thematsource.com/mat-inventory/timber-mats.html. Douglas Fir Crane Mats (12 in *4 ft. * 20 ft.), each mat consists of 4 timbers. Accessed in June 2012.
Timber Crane Mats Relocation	Backhoe Loader, 80 HP, 1 equipment operator and 2 laborers. For adjusting and relocating timber mats as needed during the project duration	Day	144	$1,888.04	$271,878	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. Crew B-11 M plus one additional laborer
Excavation of Sediment	Excavator, hydraulic, 2 CY bucket = 165 CY/hr.	BCY	40,917	$45.00	$1,841,265	Engineer's Estimate
Loading sediment onto trucks	add 15% to excavation costs	BCY	40,917	$6.75	$276,190	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 23 16.42-0020
Add long reach boom/arm for excavator	add 50% of the excavator costs	BCY	40,917	$22.50	$920,633	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 23 16.42-4250
Transport Sediment to Stockpile (staging area)	8 C.Y. truck, 15 MPH ave, cycle 1 mile, 30 min wait/Ld./ Uld.	LCY	47,055	$7.55	$355,262	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 23 23.20-0414
Stockpiling of Dredged Sediment	1 F.E. Loaders, Wheel Mounted, 2.5 CY capacity, 1 operator and laborer, available onsite full time during excavation, capping, restoration and demobilization activities.	Day	134	$1,371.22	$183,743	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. Crew B-10T
Sediment Dewatering	including debris removal, generator, shakers, belt press, and polymer dosage. Assumed Dewatering for mechanical and hydraulic dredging activities are equal.	LCY	47,055	$63.00	$2,964,437	2012 Vendor quote provided by JND Thomas Co., Inc. provided for Hydraulic dredging.
				Subtotal	**$6,970,500**	
Sediment Stabilization for Lead						
Sediment Stabilization	EnviroBlend CS, 1-3% wt./wt. dosage, 2000 # Supersacks, material only	Ton	450	$285.00	$128,250	2012 Vendor Quote from Premier Chemicals LLC.
Transportation Costs	Freight Costs, $1,300/22 sacks	Ton	450	$59.09	$26,591	2012 Vendor Quote from Premier Chemicals LLC.
ForkLift Rental	Assume Forklift rental for one day when the material would be delivered onsite	Day	1	$1,117.24	$1,117	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. Crew A-3P
Mixing Sediment with the product	Front End Loader, 5 CY bucket	LCY	11,500	$1.94	$22,310	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 312316.42-1350
Characterization Sampling of Treated Sediment	Assume 1 sample required per 100 LCY. Includes TCLP, STLC, TTLC testsmetals and PCBs	Each	115	$1,000.00	$115,000	Engineer's Estimate
				Subtotal	**$293,300**	
Transportation and Disposal of Non-hazardous sediment						
Characterization Sampling of Dewatered Sediment	Assume 1 sample required per 500 LCY. Includes analysis for metals and PCBs	Each	95	$1,000.00	$95,000	Engineer's Estimate
Loading Sediment onto Trucks	Front End Loader, 5 CY bucket, Assumed Loading will occur during the excavation and capping activites.	Day	124	$1,954.00	$242,296	2012 RSMeans Site Work and Landscape Cost Data 31st Ed. Crew B-10U
Transportation	Dump truck transport from Yosemite Slough to Landfill; incl taxes and fees	Ton	61,376	$50.00	$3,068,775	Engineer's Estimate
Disposal	Disposal at Landfill; incl taxes and fees	Ton	61,376	$50.00	$3,068,775	Engineer's Estimate
				Subtotal	**$6,474,900**	
Treatment of Dewatering Process Water						
FRAC Tank Rental; for "holding tank" of water	6 x 21,000 Tank with Cleaning	Day	144	$1,200.00	$172,800	Engineer's Estimate
Rain for Rent dewatering process water treatment system mobilization	process involves a settling tank, sand filtration, bag filter, carbon filter, resins/Organoclay, holding tank for testing	Each	1	$75,000.00	$75,000	Oakley Rain for Rent Quote from Tony DeBellis (2012)
Rain for Rent dewatering process water treatment system spent media disposal and replacement	cost is 125% of cost for mobilization for each medial replacement	Each	1	$93,750.00	$93,750	Oakley Rain for Rent Quote from Tony DeBellis (2012)
Treament System Operations	One operator	Day	144	$574.00	$82,656	2013 RSMeans Site Work and Landscape Cost Data One Equip. Oper. (med)
Characterization/Monitoring Sampling of Dewatering Process Water	Including pH, TDS, TSS, COD, Metals, PCBs. Assume one sample is needed every 10000 CF of processed water.	Each	201	$1,000.00	$201,000	Engineer's Estimate
				Subtotal	**$625,300**	
Discharge of Dewatering Process Water to SFPUC						
Permit Fee		Each	1	$1,000.00	$1,000	Engineer's Estimate
Batch Discharge to SFPUC	Sewer service charge is per 100 cubic feet discharged	100 CF	20,063	$6.56	$131,613	2012 costs from the San Franciso Public Utilities Commission. Water price of $6.55 per 100 CF.
				Subtotal	**$132,700**	
Backfilling						
Backfill (Transportation Only)	Assume the amount of material needed is equal to the amount sediment removed. Assume material is 1.5 ton/CY based on data from the Geotechnical Study. Will be available onsite.	Ton	61,376	$50.00	$3,068,775	Engineer's Estimate. Source of material has not been identified at this time.
Excavator for Installation of Cap material	Excavator, hydraulic, 2 CY bucket	LCY	47,055	$40.00	$1,882,182	Engineer's Estimate.
Add long reach boom/arm for excavator	add 50% of the excavator costs	LCY	47,055	$20.00	$941,091	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 23 16.42-4250
				Subtotal	**$5,892,100**	
Post Construction Costs						
Site Restoration for Staging Area/Access Roads	grading of access roads and staging area for paving	Day	2	$1,266.02	$2,532	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. Crew B-10L - 0.5 laborer
Site Restoration for Access road/staging area	Plant-mix Asphalt Paving with binder course 2.5" thick.	SY	9680	$11.30	$109,384	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 32 12 16.13-0130
Site Restoration for Staging Area	Plant-mix Asphalt Paving with wearing course 2.5" thick.	SY	9680	$12.55	$121,484	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 32 12 16.13-0420
Project Closeout	Phase II Investigation costs	Each	1	$25,000.00	$25,000	Engineer's Estimate
				Subtotal	**$258,500**	
				Capital Costs Subtotal:	$22,935,400	
				Adjusted Capital Cost Subtotal for San Francisco, CA Location Factor (123.4):	$28,302,300	
				10% Legal and Administrative Fees	$2,830,300	
				20% Contingencies:	$5,660,500	
				Predesign Investigations	$1,000,000	Engineer's Estimate
				Construction Management (10% of total capital cost)	$2,830,300	Engineer's Estimate
				Engineering Design (10 % of total capital cost)	$2,830,300	Engineer's Estimate
				Total Capital Costs in 2013 Dollars:	**$43,454,000**	
Annual Costs						
				Annual Cost Subtotal:	$0	
				Adjusted Capital Cost Subtotal for San Francisco, CA Location Factor (123.4):	$0	
				10% Legal and Administrative Fees	$0	
				20% Contingencies:	$0	
				Annual Total:	$0	
				30-Year Present Worth of Annual Monitoring Costs:	**$0**	

Table G-12 Cost Estimate for Mechanical Dredging for Alternative 7: Full removal where COCs exceed RGs (up to 4 feet) and Backfill
Yosemite Slough Site, San Francisco, CA

Item Description	Comment	Unit	Quantity	Unit Cost	Cost	Reference
Periodic (5-year) Monitoring for 30 years						
				5-Year Cost Subtotal:	$0	
				Adjusted Capital Cost Subtotal for San Francisco, CA Location Factor (123.4):	$0	
				10% Legal and Administrative Fees	$0	
				20% Contingencies:	$0	
				5-Year Total:	$0	
				30-Year Present Worth of Periodic Monitoring Costs:	**$0**	
				2013 Present Worth Cost:	**$43,454,000**	

Assumptions

1. Volume of Contaminated Material (Total)	40,917 BCY, as estimated using the polygon method, E&E, 2013	
2. Volume of Hazardous lead contaminated soil	10,000 BCY	
3. Perimeter around Staging area	3000 ft	
4. Area available for Staging Area	13 acre	
5. Project Duration		
Mobilization	5 days	
Dewatering and Treatment system set up	5 days	
Excavation	62 days	Total volume removed/excavation rate of 165 CY/HR. Assume 8 hours per day, 5 days per week, Assume 50% production rate.
Backfill	62 days	
Restoration	5 days	
Demobilization	5 days	
Total Project Duration	144 days	
6. Dewatering		
Volume of water from the sediment (assume that the sediment will only have 30% water, as dewatering activities would have removed most of the water)	331427.7 CF	
Volume of water that would be pumped during dewatering (assume 50 gpm, 24 hours a day during dewatering setup, excavation, capping and restoration)	1,289,840 CF	
7. In-Situ Bulk Density assumed for the project is	1.5 Tons/BCY	
8. Swell Factor was assumed to be	15%	

9. Assume access road preparation will disturb 1 acre and the staging area will disturb 1 acre for a total of 2 acres.
10. After construction activities are completed, the disturbed two acres will require pavement restoration.
11. The surveying crew will be needed for the entire project duration to compete a pre-excavation, post-excavation, and post capping surveys and to assist the excavation crew.
12. The cofferdam needed is 1000' (length) by 36' (depth). Assume that a silt curtain will be in place during the installation and removal of the cofferdam.
13. Assume 5000 gallons of water/decon setup would be needed daily for decontamination purposes. Assume this water will be treated by the dewatering process water treatment facility.
14. Approximately 200 timber crane mats will be needed for the entire project.
15. One sample is needed every 10,000 CF of processed water.
16. The Suspended Solids, Oil/Grease and COD will be removed during the sediment dewatering process.
17. Assume that there is a manhole located onsite discharge of treated dewatering process water.
18. Assume there is a fire hydrant onsite for the supply of decontamination water.
19. Onsite material from access road creation will be used to fill in depressions created by debris removal.
20. Amount of backfill material needed for bank treatment is 1000' bank length x 50' width x 2' depth.
21. Assume 10 truck loads of debris will be removed from banks.
22. Present worth of costs assumes 5% annual interest rate.
23. Unit costs listed were obtained from 2012 RS Means Cost Data and engineering judgement.
24. Institutional Controls at the site are expected to include deed restrictions, informational signs and dissemination of information by the State Parks to the general public.

Key:
LF = Linear Foot
SY = Square Yard
BCY = Bank Cubic Yard
LCY = Loose Cubic Yard
LS = Lump Sum
SF = Square Feet
CF = Cubic Feet

Table G-13 Cost Estimate for Hydraulic Dredging for Alternative 7: Full removal where COCs exceed RGs (up to 4 feet) and Backfill
Yosemite Slough Site, San Francisco, CA

Item Description	Comment	Unit	Quantity	Unit Cost	Cost	Reference
Capital Cost						
Institutional Controls		Each	1	$25,000.00	$25,000	Engineer's estimate
				Subtotal:	**$25,000**	
Preconstruction/Site Preparation						
Site Preparation, access road construction, site survey, mobilization and demobilization of equipment	Includes construction of 8" HDPE pipe for sediment transport to staging area, and launching of the dredge, See assumptions below for additional details on what is included in the mobilization costs	LS	1	$400,000.00	$400,000	Quote from JND Thomas Co, Inc.
Install Fence	Chain link industrial, 6' H, 6 gauge wire with 3 strands barb wire; around staging area	LF	3000	$30.00	$90,000	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 32 31 13.20-0500
Gate	Double swing gates, includes posts with 12' opening	Each	2	$1,100.00	$2,200	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 32 31 13.20-5060
Signs	Reflectorized 24"x 24" sign mounted to fence	Each	4	$130.00	$520	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.10 14 53.20-0100; increase by 50% for text customization
Office Trailer Rental	Office trailer, furnished, rent per month, 50' x 12' excl. hookups. + air conditioning. Assume 6 month rental	MO	6	$425.50	$2,553	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 52 13.20 0550
Office Trailer Delivery	Office trailer, delivery and pickup, assume 40 miles/round trip	MI	40	$11.65	$466	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 52 13.20 0800
Trailer Telephone	Field office expense - telephone bill; avg. bill/month, incl. long distance., Assume 6 month rental	MO	6	$89.00	$534	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 52 13.40 0140
Lights and HVAC	Field office expense - field office lights & HVAC., Assume 6 month rental	MO	6	$167.00	$1,002	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 52 13.40 0160
Sanitary Facilities	Rent toilet, portable, chemical, Assume 6 month rental	MO	6	$183.00	$1,098	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 01 54 33.40 6410 (Construciton Aids)
Three Phase power supply	Assume cost for setting up electrical service to operate equipment to be around $20,000	LS	1	$20,000.00	$20,000	Engineer's Estimate
Utility Cost during Project activities	Assume $15,000	LS	1	$15,000.00	$15,000	Engineer's Estimate
Bank Treatment Debris Removal	Cost for removing debris located along the Slough banks. Assume 1 Gradall, 3 ton, 1 CY, 1 Equipment Operator, 4 laborers	Day	5	$3,448.20	$17,241	2013 RSMeans Site Work and Landscape Cost Data Crew B-12 K + 3 laborers
Bank Treatment Transport Debris to Staging Area	Assume 50 truck loads of debris will be removed from banks. 8 C.Y. truck, 15 MPH ave, cycle 1 mile, 30 min wait/Ld./ Uld.	LCY	400	$7.55	$3,020	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 23 23.20-0414
Transportation of Collected Debris	Debris removed for staging area/access road construction and other Debris. Dump truck transport from Yosemite Slough to Landfill; incl taxes and fees	Ton	600	$50.00	$30,000	Engineer's Estimate
Disposal of Collected Debris	Debris removed for staging area/access road construction and other Debris. Disposal at Landfill; incl taxes and fees	Ton	600	$50.00	$30,000	Engineer's Estimate
Bank Treatment Backfill	Assume 1-1/2" crushed stone will be used to fill in depressions that could potentially could form during excavation activities. Assume 500 CY of fill, includes cost for spreading, 2 mi RT Haul	LCY	500	$42.00	$21,000	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.31 05 16.10 0300
Erosion and Sediment Controls - Jute Mesh	Includes Jute Mesh 100 SY per roll, 4' wide, stapled, 2 acres	SY	9,680	$2.06	$19,941	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 25 14.16 0020
Erosion and Sediment Control - Silt Fence & Hay Bales	Includes Silt Fence, polypropylene, 3' high, adverse conditions & Hay Bales, staked	LF	3,000	$11.75	$35,250	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 25 14.16 1100 + 1250
				Subtotal:	**$689,825**	
Health and Safety						
Health and Safety Plan	Prepare Site-specific health and safety plan as well as prepare community notification documents	Each	1	$10,000.00	$10,000	Engineer's Estimate
Construct Decontamination Pad & Containment	For equipment and personnel, Assume 4 setups will be needed.	Setups	4	$5,000.00	$20,000	Engineer's Estimate
Water Supply for Decontamination phases	Assume daily water need for decontamination process is 5,000 gallons/setup.	100 CF	7,861	$5.10	$40,091	2012 costs from the San Franciso Public Utilities Commission. Water price of $5.10 per 100 CF.
Community/Exclusion Zone Air Monitoring	Particulate meter purchase (Qty 4)	Each	4	$7,200.00	$28,800	Industrial Environmental Monitoring Instruments, http://www.ierents.com/ as of January 2012
Site Safety Officer	10 hrs/day, 5days/wk, $100/hr; 100% of project duration	manweeks	59	$5,000.00	$294,000	Engineer's Estimate
				Subtotal:	**$392,900**	
Construction Costs						
Construction Oversight	10 hrs/day, 5days/wk, $100/hr; 100% of project duration	manweeks	59	$5,000.00	$294,000	Engineer's Estimate
				Subtotal:	**$294,000**	
Hydraulic/Turbidity Controls						
Hydraulic/Turbidity Controls	Assume uniform $1,000,000 placeholder for all alternatives	LS	1	$1,000,000	$1,000,000	Engineer's Estimate
				Subtotal:	**$1,000,000**	
Contaminated Sediment Removal (Hydraulic Dredging)						
Sediment removal and pumping to sediment dewatering plant at site access area through an 8" HDPE pipeline	using the Moray 8" Swinging Ladder Dredge	BCY	40,917	$63.00	$2,577,771	Vendor quote from JND Thomas Co., Inc.
Cofferdam Construction and Removal	Based on supply and installation of cofferdam	LS	1	$410,000.00	$410,000	Vendor quote from JND Thomas Co., Inc.
				Subtotal:	**$2,987,800**	
Sediment Dewatering and Characterization						
Mechanical Dewatering System and Dewatered Sediment Stockpiling	The dewatering system is expected to include Two Dual Tandem Shakers, Two Mix tanks, 4 14" Hydro-cyclones, Hydro-clear HC2500 Clarifier, Three belt presses, polymer dosage and additional storage tank prior to disposal to the slough. Flow is expected to be around 2000 gpm. Includes costs for Characterization and monitoring costs	LCY	47,055	$63.00	$2,964,437	Vendor quote from JND Thomas Co., Inc.
				Subtotal:	**$2,964,500**	
Sediment Stabilization for Lead						
Sediment Stabilization	EnviroBlend CS, 1-3% wt./wt. dosage, 2000 # Supersacks, material only	Ton	450	$285.00	$128,250	2012 Vendor Quote from Premier Chemicals LLC.
Transportation Costs	Freight Costs, $1,300/22 sacks	Ton	450	$59.09	$26,591	2012 Vendor Quote from Premier Chemicals LLC.
ForkLift Rental	Assume Forklift rental for one day when the material would be delivered onsite	Day	1	$1,117.24	$1,117	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.Crew A-3P
Mixing Sediment with the product	Front End Loader, 5 CY bucket	LCY	11,500	$1.94	$22,310	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 312316.42-1350
Characterization Sampling of Treated Sediment	Assume 1 sample required per 100 LCY. Includes TCLP, STLC, TTLC testsmetals and PCBs	Each	115	$1,000.00	$115,000	Engineer's Estimate
				Subtotal:	**$293,300**	

Table G-13 Cost Estimate for Hydraulic Dredging for Alternative 7: Full removal where COCs exceed RGs (up to 4 feet) and Backfill
Yosemite Slough Site, San Francisco, CA

Item Description	Comment	Unit	Quantity	Unit Cost	Cost	Reference
Transportation and Disposal of Non-hazardous sediment						
Characterization Sampling of Dewatered Sediment	Assume 1 sample required per 500 LCY. Includes analysis for total metals and PCBs, TCLP, hexavelent chromium, paint filter test	Each	95	$1,000.00	$95,000	
Loading Sediment onto Trucks	Front End Loader, 5 CY bucket, Assumed Loading will occur during the excavation and capping activites.	Day	274	$1,954.00	$535,396	2012 RSMeans Site Work and Landscape Cost Data 31st Ed. Crew B-10U
Transportation	Dump truck transport from Yosemite Slough to Landfill; incl taxes and fees	Ton	61,376	$50.00	$3,068,775	Engineer's Estimate
Disposal	Disposal at Landfill; incl taxes and fees	Ton	61,376	$50.00	$3,068,775	Engineer's Estimate
				Subtotal:	**$6,768,000**	
Treatment of Decontamination Process Water						
FRAC Tank Rental; for "holding tank" of water	4 x 21,000 Tank with Cleaning	Day	294	$800.00	$235,200	Engineer's Estimate
Rain for Rent dewatering process water treatment system mobilization	process involves a settling tank, sand filtration, bag filter, carbon filter, resins/Organoclay, holding tank for testing	Each	1	$75,000.00	$75,000	Oakley Rain for Rent Quote from Tony DeBellis (2012)
Rain for Rent dewatering process water treatment system spent media disposal and replacement	cost is 125% of cost for mobilization for each medial replacement	Each	1	$93,750.00	$93,750	Oakley Rain for Rent Quote from Tony DeBellis (2012)
Treament System Operations	One operator	Day	294	$574.00	$168,756	2013 RSMeans Site Work and Landscape Cost Data One Equip. Oper. (med)
Characterization/Monitoring Sampling of Dewatering Process Water	Including pH, TDS, TSS, COD, Total Metals, PCBs. Assume one sample is needed every 10000 CF of processed water.	Each	168	$1,000.00	$168,000	Engineer's Estimate
				Subtotal:	**$740,800**	
Discharge of Dewatering Process Water to SFPUC						
Permit Fee		Each	1	$1,000.00	$1,000	Engineer's Estimate
Batch Discharge to SFPUC	Sewer service charge is per 100 cubic feet discharged. Only for Water from the decon activities	CF	16,701	$6.56	$109,558	2012 costs from the San Franciso Public Utilities Commission. Water price of $6.55 per 100 CF.
				Subtotal:	**$110,600**	
Backfilling						
Backfill (Transportation Only)	Assume the amount of material needed is equal to the amount sediment removed. Assume material is 1.5 ton/CY based on data from the Geotechnical Study	Ton	61,376	$50.00	$3,068,775	Engineer's Estimate. Source of material has not been identified at this time.
Excavator for Installation of Backfill material	Excavator, hydraulic, 2 CY bucket	LCY	47,055	$40.00	$1,882,182	Engineer's Estimate.
Add long reach boom/arm for excavator	add 50% of the excavator costs	LCY	47,055	$20.00	$941,091	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed.31 23 16.42-4250
Backfill Installation	2-1/2 CY FE Loader, 130 HP, 300' Haul, with Dozer	LCY	47,055	$45.00	$2,117,455	Engineer's Estimate
				Subtotal	**$8,009,600**	
Post Construction Costs						
Site Restoration for Access Roads	grading of access roads	Day	2	$1,266.02	$2,532	2013 RSMeans Site Work and Landscape
Site Restoration for Staging Area	Plant-mix Asphalt Paving with wearing course 2.5" thick. Assume 2 acres will be disturbed	SY	9680	$12.55	$121,484	2013 RSMeans Site Work and Landscape Cost Data 32nd Ed. 31 12 16.13-0420
Project Closeout	Phase II Investigation costs	Each	1	$25,000.00	$25,000	Engineer's Estimate
				Subtotal	**$149,100**	
				Capital Costs Subtotal:	$24,425,425	
				Adjusted Capital Cost Subtotal for San Francisco, CA Location Factor (123.4):	$30,141,000	
				10% Legal and Administrative Fees	$3,014,100	
				20% Contingencies:	$6,028,200	
				Predesign Investigations	$1,000,000	Engineer's Estimate
				Construction Management (10% of total capital cost)	$3,014,100	Engineer's Estimate
				Engineering Design 10 % of total capital cost	$3,014,100	Engineer's Estimate
				Total Capital Costs in 2013 Dollars:	**$46,212,000**	
Annual Costs						
				Annual Cost Subtotal:	$0	
				Adjusted Capital Cost Subtotal for San Francisco, CA Location Factor (123.4):	$0	
				10% Legal and Administrative Fees	$0	
				20% Contingencies:	$0	
				Annual Total:	$0	
				30-Year Present Worth of Annual Monitoring Costs:	**$0**	
Periodic (5-year) Monitoring for 30 years						
				5-Year Cost Subtotal:	$0	
				Adjusted Capital Cost Subtotal for San Francisco, CA Location Factor (123.4):	$0	
				10% Legal and Administrative Fees	$0	
				20% Contingencies:	$0	
				5-Year Total:	$0	
				30-Year Present Worth of 5-Year Costs:	**$0**	
				2013 Present Worth Cost:	**$46,212,000**	

Table G-13 Cost Estimate for Hydraulic Dredging for Alternative 7: Full removal where COCs exceed RGs (up to 4 feet) and Backfill
Yosemite Slough Site, San Francisco, CA

Item Description	Comment	Unit	Quantity	Unit Cost	Cost	Reference

Assumptions

1. Volume of Contaminated Material	40,917	BCY, as estimated using the polygon method, E&E, 2013	
2. Volume of Hazardous lead contaminated soil	10,000	BCY	
3. Perimeter around staging area	3000	ft	
4. Area available for Staging Area	13	acre	
5. Project Duration			
Mobilization	5	days	
Dewatering and Treatment system set up	5	days	
Dredging	137	days	Dredging rate is 300 CY/day. Assume 5 days per week
Capping	137	days	
Restoration	5	days	
Demobilization	5	days	
Total Project Duration	294	days	
6. Volume of water generated from staging area activities (the dewatering water treatment costs have been included in the vendor cost for dewatering activities)	884,000	CF	
7. In-Situ Bulk Density assumed for the project is	1.5	Tons/BCY	
8. Swell Factor was assumed to be	15%		

9. Assume access road preparation will disturb 1 acre and the staging area will disturb 1 acre for a total of 2 acres.
10. After construction activities are completed, the disturbed two acres will require pavement restoration.
11. The surveying crew will be needed for the entire project duration to compete a pre-excavation, post-excavation, and post capping surveys and to assist the excavation crew.
12. Two cofferdams will be installed to contain the flow during the hydraulic dredging activities. Assume that a silt curtain will be installed as part of this process.
13. Assume 10,000 gallons of water would be needed daily for decontamination purposes. Assume this water will be treated by the dewatering process water treatment facility.
14. One sample is needed every 10,000 CF of processed water.
15. The Suspended Solids, Oil/Grease and COD will be removed during the sediment dewatering process.
16. Assume that there is a manhole located onsite discharge of treated dewatering process water.
17. Assume there is a fire hydrant onsite for the supply of decontamination water.
18. Onsite material from access road creation will be used to fill in depressions created by debris removal.
19. Amount of backfill material needed for bank treatment is 1000' bank length x 50' width x 2' depth.
20. Assume 50 truck loads of debris will be removed from banks.
21. Present worth of costs assumes 5% annual interest rate.
22. Unit costs listed were obtained from 2012 RS Means Cost Data and engineering judgement.
23. Mobilization costs provided by the vendor includes three phases of mobilization. Phase I includes obtaining permits, constructing access roads, site prep, erosion/stormwater control fencing, safety signs etc and Turbidity curtains. All other measures such as monitoring processes and traffic regulations necessary will be put in place. Phase II will involve the installation of dewatering equipment and the launching of dredges as well as installation of dredge pipes. Phase III will include testing of equipment, surveying, work layout and staking of the pond. Set up of water and power will also be
24. Institutional Controls at the site are expected to include deed restrictions, informational signs and dissemination of information by the State Parks to the general public.

Key:
LF = Linear Foot
SY = Square Yard
BCY = Bank Cubic Yard
LCY = Loose Cubic Yard
LS = Lump Sum
SF = Square Feet
CF = Cubic Feet

H

Responsiveness Summary (Response to Public Comments on the Draft EE/CA dated July 2013)

No.	*Page*	*Line/Para/Sec*	*Comment*	*EPA Response*
Spoken Comments at U.S. EPA Public Meeting on August 21, 2013				
1.			One of my concerns has nothing to do with our neighborhood. It has to do with the fact the natural cleanup of our environment for some of the PCBs is not happening. So it's always been my problem that we are taking our problem, putting in a landfill that a hundred years from now somebody's going to build on it. What --? Is there any --? On the land deed, is there anything that will notice folks a hundred years from now that this is contaminated material that was dumped in your area?	Yes, all authorized waste disposal facilities (i.e., landfills) in California and throughout the country are required to put a notice on their property deeds regarding the type of facility that is operating or has operated at the property. These notices are intended to prevent future redevelopment on the property and development that is not compatible with the historical uses of the property.
2.			The sewer pipes. Do those have a possibility of recontaminating later on?	Yes, the three combined sewer overflows (CSOs) at Yosemite Slough present a threat of re-contamination after the cleanup action is complete. However, the EPA is fully aware of these three CSOs and we will ensure that appropriate steps are taken to prevent the CSOs from re-contaminating the Yosemite Slough Site in the future. The EPA intends to have the San Francisco Public Utility Commission (SFPUC) conduct technical studies regarding the chemical mass loading and volumetric flowrate coming from their CSOs to determine if these loadings will threaten the selected response action's (Alternative 5) capacity to comply with the site removal action objectives (RAOs) and site remedial goals (RGs). The SFPUC has previously conducted preliminary tests of these CSOs and the results are encouraging (O'Neil 2011 and SFPUC 2009). However, now that the final response action has been selected for the Site, the EPA will require additional tests and an evaluation of the CSOs during the remedy design stage. As a result of these tests and evaluation, the EPA will integrate appropriate mitigation measures into the response action design to ensure the CSOs do not threaten success of the Yosemite Slough Site cleanup.

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3.			I have a question pertaining to not the slough, but the area that's being -- has already been repaired. What is the contamination level of that ground, or does this not concern --?	Yes, there is some contaminated land surrounding the Yosemite Slough Site. During the remedy design stage, the EPA will consider the importance of this contamination with respect to the success of the Yosemite Site Cleanup. For example, the selected response action, Alternative 5, requires several technical studies and actions (e.g. CSO studies, Slough Bank Stabilization, Reasonable Upland Source Control, and groundwater monitoring) to better identify, evaluate, and mitigate threats to cleanup success. In addition, the State of California Department of Parks and Recreation (CDPR) has already begun cleaning up contaminants and restoring wetlands plants and habitat on its property immediately around Yosemite Slough. The CDPR has completed its Phase 1 project on the north side of the slough and subsequent cleanup and phases are being planned. The CDPR is doing this under an order from the California State Water Resources Control Board (Water Board). The Water Board's Order requires soil cleanup standards that must be achieved (Water Board 2011).
4.			My name is Jose Jimenez, To start off my presentation, I think it's great to see that we're cleaning up Monsanto's mess, the company that creates all the pesticides and insecticides that were used in the past couple decades. National -- National Geographic released an article in 2008, five years ago, about lead-tolerant worms that changed the chemistry in the meadows such that it becomes inert, and it allows plants to process it much easily. I believe that can also be of great use to the marshland, knowing that the lead levels are above average. And I believe that as like a -- a process before about dredging the water, it might be useful maybe to put those worms out there and get that lead to become inert. That way the plants can process it much easily. And also, I did some research, and I found out that vitamins, B12s, are nucleophiles, and they're also reducing catalyst, which means that they reduce the time between chemical reactions and that they are -- they're also -- they can potentially dechlorinate polychlorinated biphenyl, PCBs. So it may also help in doing that process. So that's what I got to say.	Thank you for your interest in innovative methods using natural processes such as earth worms to render toxic substances less toxic. The EPA shares your interest in this important topic. At this point, the EPA is not aware of aquatic marine-based worms that can cause a beneficial remediation result. The earthworms described in the National Geographic article live in soil and would not survive the salt water environment of Yosemite Slough. The earthworms described in the article remove metals from soils in conjunction with terrestrial plants growing in the soils and would not likely be effective in removing PCB contamination. During the remedy design phase, the EPA will search the research literature on this topic further to determine if there are marine invertebrates that do exist that exhibit similar resistance to, and mobilization of, metals.

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				However, even if such marine invertebrates exist, birds and fish would prey on these invertebrates and likely uptake the contaminants into the food web.
5.			Greetings. Anthony Khalil, A-n-t-h-o-n-y, K-h-a-l-i-l. Greetings. Thank you, Jose, for kind of start the public comment of this. I want to kind of put -- I want to be cogent, but I also want to thank Mr. Cooper for the presentation, kind of the framework for this cleanup. Something I think that was omitted was the fact that -- you know, that probably gleaned from the paper that came out was the fact that this is the first official cleanup of Yosemite Slough in its history. And we have quite an opportunity here, okay. With that opportunity, I feel we have to conduct and invest to prevent recontamination. That's the piece to focus that I would like to highlight because we are making the investment in the southern shoreline. As you can see, it's transforming. I've been part of this transformation personally for close to 15 years now in the southern shoreline in ecological restoration work. But I come here as, you know, someone who's part of this community. I don't live here, but I've been working here for close to 15 years, and it's a part of my great community that I feel is -- is integral of being an urban resident, my ability to access open space, my ability to nourish and steward our ecological treasures like Yosemite Slough. So I want to highlight that as well. And I appreciate Mr. Cooper giving this -- this picture that it is a watershed that connects to McLaren Park. And it is quite a living classroom. I facilitated, you know, thousands of students to access the shoreline as a community park but with a state park. And something of interest to me is this opportunity for a living shoreline approach. And it's taken the perspective that the shoreline will evolve over time. And we have this potential maybe to not just rid it of toxins, but bring in what we do want to see, and that is increasing wetland habitat, that is increasing the next generation's potential to engage with their natural environments. And here we are in this -- in this area, Bret Harte, right, which is literally a stone's throw from the slough. So we do have to make this -- you know, take this opportunity and really plan for the future. And what I mean by that is creating a living shoreline through means of -- I am a scientist, you know, by training. And so my approach is say sure, let's go into subtidal restoration and really start thinking about oyster beds and how they filter our waters and how -- and then how they process contaminate. And then I start thinking about the approach of, of course, terrestrial restoration, you know, restarting our wetlands, what these areas once were. But again, we're in a urban setting, and we have to -- we have to think about price. We have to think about, of course, the techniques; and we	The EPA agrees that there is an important connection between the health of the Bayview community and the long-term success of the Yosemite Slough Site cleanup and other shoreline cleanup programs in eastern San Francisco County. The EPA also agrees that preventing exposures to toxic chemicals and the restoration of the shoreline (i.e. re-planting and encouraging the return of healthy natural processes) are essential to the long-term health of Yosemite Slough. In addition, as described in the EE/CA, Section 3.2, the EPA understands that upland source controls measures must be undertaken to address the threats of slough recontamination. The EPA's selected response action, Alternative 5, includes slough bank stabilization to prevent recontamination via erosion of the slough banks. The EPA will collaborate with state agencies, the City of San Francisco, and local non-profit groups to identify and implement appropriate upland source control measures needed to protect the success of the Yosemite Slough Site cleanup.

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			have to also think about what is the investment that future generations would pay. So without getting into those complexities, I want to recommend is -- is taking a living shoreline approach, and I hope to do influence that with a formal recommendation, writing it and continuing this dialogue through -- through multiple means, this kind of hybrid approach that is valuing people's connection to their local environs, which is in my opinion an inalienable right. It's everyone's right to get access to open space that is adjacent to their doorways or not and in this urban kind of quandary of saying, well, how do we rid of these contaminants now, but how do we enhance and increase our connection and our general comfort with our environment? You know, we're sitting here, and to me I think of mud as sediment, okay. But also for some I also have a humility to understand that yeah, it's just mud. Who cares about that? But if we understand and we're informed and there's -- there's groups that I work with professionally that want to disseminate this information and not just say, hey, it's polluted. But no, here is the opportunity on how we can kind of reverse this legacy. So I really want to stress this approach, and I hope to make a formal recommendation on how to prevent the recontamination and how to actually increase it ecologically but socially as well. So thank you all.	
Written Comment from David Froehlich transmitted via email dated August 14, 2013				
6.			I have briefly skimmed the PDF about the cleanup and hope to attend the meeting on 8/21 but a quick concern that came up was how they were going to truck the contaminated soil from the site out of the city and what will prevent it from being deposited along the truck route through our neighborhoods? Thanks in advance for your response and hope to be at the meeting!	Figures 7-1 and 7-2 present preliminary truck routes to be used to haul away sediment from a potential sediment processing area at the Candlestick Park Overflow Parking Lot or the Pier 96 facility area respectively. In either scenario, the preliminary truck routes would minimize use of roads within residential areas of the Bayview neighborhood. In addition, the EE/CA, Section 8.5.1, states that a Traffic Management Plan will establish Project criteria for minimizing truck travel in residential areas, covering loaded trucks so that contaminated soil, mud or dust is not released, spilled or tracked onto public streets in the Bayview neighborhood. At the Project design phase, specific details regarding the mud drying locations, final truck, rail or barge haul routes, and transportation protocols will be described in the Project specifications and the Traffic Management Plan.

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Written Comments from Keith Foreman, U.S. Navy BRAC Environmental Coordinator, Hunters Point Naval Shipyard, transmitted via email dated September 12, 2013				
7.		General Comment	EE/CA does not adequately address the implications of the new configuration of Yosemite Slough. The changes in hydrodynamic conditions resulting from the construction of a wetland on the north side of the slough is described in the EE/CA as a data gap that will be addressed during pre-design. It is questionable whether evaluating the changes in hydrodynamic conditions and potential impacts of wetland construction on contaminant distribution should be postponed to pre-design. All of the alternatives are based on the contaminant distribution prior to the wetland construction project. The removal footprint shown in the EE/CA for each alternative could be different as a result of the new configuration. In addition, the new configuration may have resulted in increased polychlorinated biphenyl (PCB) flux between the Slough and the South Basin resulting in potential for greater dispersion of PCBs out of Yosemite Slough. The text states that preventing site recontamination and contaminant migration to adjacent areas is one of the removal action objectives, yet recontamination may have already occurred as a result of the wetland construction project.	The EPA acknowledges that the actual hydrodynamics of the Yosemite Slough Site will be influenced by recent and upcoming changes to the configuration of the slough shoreline. The EE/CA, Section 2.6, states that based on a modeling study by Noble Consultants, Inc., the CDPR Yosemite Slough Wetlands Restoration Project design is expected to result in most of the restoration area being inundated by water from the San Francisco Bay less than 20% of the time, with maximum tidal current velocities less than 0.05 m/sec. This report concludes that weak tidal currents in the restoration area will not likely induce any resuspension of sediment or induce any noticeable erosion in the Yosemite Slough. Nevertheless, the EE/CA, Section 9.3, identifies the need for limited sediment contaminant data gap testing event at the Yosemite Slough Site to support the configuration of the dredging component in the remedy design. Barring any unusually significant storm events prior to implementation of the selected response action, the EPA believes that actionable sediment contaminant concentrations within the Yosemite Slough Site are now and will continue to be generally stable within the Site. The Noble Consultants Study states that wave action induced by the 10-year to 50-year storm events could induce erosion at the mouth of the Slough with greater erosion potential east of the Site in South Basin. During periods of wave action, sediment deposition will also occur; therefore, the actual net erosion during the extreme storm events may be less than the estimated erosion potential. Because this concern represents a data gap with regards to the potential for deposition, erosion, or scour, the EE/CA, Section 9.3, also requires hydrodynamic modeling of the Yosemite Slough Site during the design stage to better estimate net erosion potential

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				within the Site based on the current and future projected geometries of the slough to ensure the long-term protectiveness of the selected response action for the Site.
8.		General Comment	The Parcel F remedial goals are misrepresented. The EE/CA text states that the removal action objectives and remediation goals for Yosemite Slough were developed to be consistent with the Parcel F remediation goals. The EE/CA is not completely accurate and misrepresents the remediation goals for Parcel F. The EE/CA states that Parcel F has a remedial goal for PCBs based on an area weighted average of 386 micrograms per kilogram (µg/kg), which is not accurate. The 386 µg/kg value is the calculated post-remediation area weighted average concentration in South Basin after the 1,240 µg/kg not-to-exceed remediation goal has been applied. It is not a preliminary or a final remediation goal. During the development of the remediation goals for Parcel F, the regulatory agencies requested that field-collected tissue data be considered. The Navy and regulatory agencies agreed on a risk management approach of using the field-collected tissue data results to bound the range of site use factor (SUF) used to develop the preliminary remediation goals. It was agreed that a SUF of 0.5 to a SUF of 1.0 would be evaluated which resulted in a corresponding range of preliminary remediation goals (See Table 2-2 of the Parcel F FS). Ultimately, the remediation goals were defined as "do-not-exceed" values reflecting a SUF of 0.5 to result in an area weighted average for the COCs representing the ecological preliminary remediation goal based on a SUF of 1.0 (PCB concentration of 620 µg/kg). The final remediation goal for PCBs in Parcel F is 1,240 µg/kg, which the Navy and agencies agreed to apply as a not-to-exceed value (See Table 2-3 of the Parcel F FS).	In response to this comment, the EPA revised the EE/CA to clarify the following: (1) the Navy's current position is that the sediment remediation goal (RG) for PCBs in Hunters Point Naval Shipyard Parcel F (Parcel F) is only the not-to-exceed (NTE) standard of 1,240 micrograms per kilogram (µg/kg) PCBs; (2) the 386 µg/kg area weighted average (AWA) remediation goal PCBs is based on the EPA's understanding of the Navy's response to regulatory agency comments on Parcel F documentation. As explained in the EE/CA, Section 4.2.2.1, with respect to cleanup of PCBs in Yosemite Slough, it is EPA's position that both the 1,240 µg/kg NTE RG and the 386 µg/kg AWA RG are essential for a protective cleanup. The EPA believes both standards are appropriate for contaminated sediment in Parcel F as well. The EE/CA will continue to adopt both the NTE and AWA sediment remediation goals for PCBs at the Yosemite Slough Site. The EPA will coordinate with the Navy and state agencies to ensure that protective standards are ultimately adopted in Parcel F as well.
9.	2-2	2.2	"Hunters Point Shipyard Superfund Site" should be changed to "Hunters Point Naval Shipyard".	The EE/CA was edited to make this change.
10.	3-9	3.4.2	This section reports that the distributions of lead and PCBs are similar, and that remediation based on PCBs will also address risks due to lead and reduce concentrations of other contaminants. How was co-occurrence of PCBs and lead established?	During the development of the EE/CA, the EPA mapped PCB and lead contaminant data Site-wide. The EE/CA, Section 3.4.2, was edited to add additional information regarding the general co-occurrence of PCB and lead exceedances. As stated in Section 3.4.2, out of the 36 sediment sample locations Sitewide, only two sample locations (YC-017 and YC-024) show

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				concentrations of lead above the screening level when PCB concentrations are less than the screening level.
11.	3-7	3.3.2	The total PCB concentrations for Yosemite Slough sediments are calculated as either the sum of detected Aroclor concentrations, or the sum of 28 PCB congeners X 2.3. The site-specific PCB remediation goal for HPNS Parcel F is based on the sum of the NOAA National Status and Trends (NS&T) 18 congeners X 2. The EE/CA should calculate total PCB concentrations for Yosemite Slough sediments using the same method that was used for the Parcel F remediation goal to provide consistent comparison of site data to the remediation goal. Alternatively, the EE/CA could provide an analysis demonstrating that the various methods of calculating total PCB concentrations provides sufficiently comparable results.	The EPA conducted a cursory review of its PCB analytical laboratory data set for Yosemite Slough and found that PCBs detections were focused on less than 15 congeners. Therefore, total PCB concentrations based on 18 congeners times 2 (as used by the Navy in Parcel F) or 28 congeners times 2.3 (as used by the EPA in Yosemite Slough) would result in essentially the same total concentration within a 10% error range. Although minor edits were made to the EE/CA, Section 3.3.2, to clarify the EPA's method to calculate total PCB concentrations, the EE/CA was not edited to present total PCB concentrations based on 18 x 2 as such calculations are un-necessary as both the Navy and EPA total PCB concentrations for Parcel F and Yosemite Slough respectively are considered accurate and representative of PCB contamination at both sites.
12.	4-6	4.2.2.1	This section should describe the human health preliminary remedial goals for HPNS Parcel F. The human health preliminary remedial goals for PCBs in sediment ranged from 135 µg/kg to 13,500 µg/kg for cancer risks of 1 X 10^{-6} to 1 X 10^{-4}, respectively. Additionally, as noted in the General Comments, the area weighted average of 386 µg/kg is not a remediation goal for Parcel F. Applying the do-not-exceed remediation goal of 1,240 µg/kg, which corresponds to the ecological preliminary remedial goal based on a SUF of 0.5, should result in a post-remediation area weighted average of 386 µg/kg. This area weighted average is below the more protective ecological preliminary remediation goal based on a SUF of 1 (620 µg/kg).	See the EPA's response to Navy General Comment Number 2 above. The EE/CA, Section 4.2.2.1, was edited to clarify the Navy's human health preliminary remedial goals for Parcel F. However, it continues to be the EPA's position that both the NTE and AWA RGs for PCBs in sediment are needed at the Yosemite Slough Site for protection of both human health and ecological receptors.
13.	4-7	4.2.2.2	The text states, "The Navy found that surf scoters may be at risk from ingested doses of copper, lead, mercury, and PCBs, if the birds obtain more than 50% of their daily food intake from the South Basin." Copper and mercury were not found to pose a risk to benthic-feeding birds in South Basin.	The EE/CA, Section 4.2.2.2, was edited to remove reference to copper and mercury as posing a risk to benthic-feeding birds in the South Basin.
14.	4-8	4.2.2.2	The text states, "The Navy concluded that the cleanup goals for PCBs in Parcel F sediment that were developed for the protection of human health	The EE/CA, Section 4.2.2.2, was edited as requested.

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			were also protective of current ecological receptors." This sentence should be revised to indicate that the reverse was the case - the Navy concluded that the PCB cleanup goals based on the protection of ecological receptors were also protective of human health.	
15.		Table 6-1	As described under General Comments, the 386 µg/kg is not a remediation goal for Parcel F; the reference for the PCB remediation goal of 1,240 µg/kg should be the Parcel F FS (April 2008).	See the EPA's response to Navy General Comment number 2. Table 6-1 in the EE/CA was edited to clarify that the EPA's selected sediment RGs for PCBs are based on the Navy Parcel F feasibility study (FS) and the EPA's understanding of the Navy's response to regulatory agency comments on the Parcel F FS.
16.	6-3	6.2	The text states, "This goal was derived from human health and ecological risk assessment work …" The remediation goal of 1,240 µg/kg is based on the protection of benthic-feeding birds (ecological risk) only. This remediation goal was found to be protective of human health.	The EE/CA, Section 6.2, was edited as requested.
17.	7-4	7.1.3	The text states, "The May 2, 2005, HPNS Parcel F Validation Study Report estimates approximately 6 to 8 cm/yr of sediment accumulation based on radioisotope data from two locations within the Slough. However, the Navy later modified this estimate by stating that the dates and sediment accumulation rates determined for the cores from Yosemite Slough should be considered unreliable given the disrupted radioisotope profiles." Both the estimates of the sediment accumulation rates in Yosemite Slough and the assessment of their reliability were reported concurrently in Appendix M of the Parcel F Validation Study Report (2005).	The EE/CA, Section 7.1.3, was edited as requested.
18.	7-4	7.1.3	The correct references for sediment accumulation rates in South Basin are Appendix M of the Parcel F Validation Study Report (2005) and Appendix E of the Parcel F FS Data Gaps Technical Memorandum (2007).	The EE/CA, Section 7.1.3, was edited as requested.

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19.	7-4	7.1.3	A decrease in organochlorine pesticide concentrations in sediment between 1998-2000 and 2009-2012 is cited as evidence of natural recovery. Other lines of evidence should also be developed and considered. Do concentrations of other contaminants show a similar decline in the same time frame? Multiple lines of evidence indicate that natural recovery is occurring in South Basin due to progressive burial by relatively cleaner sediment from San Francisco Bay. Most of the 2009 sediment cores from Yosemite Creek have similar profiles as the cores from South Basin, with a distinct subsurface peak in PCB concentration, typically between 1-2 or 2-3 feet below the sediment surface.	The EE/CA, Section 3.3.3, states that the concentrations of organochlorine pesticides have naturally attenuated and the frequency of detections are statistically low enough to no longer be considered as contaminants of concern (COCs). For purposes of the EE/CA, lead and PCBs are the only COCs carried through to the alternatives analysis. The EE/CA, Section 7.1.3, states that some evidence of natural recovery via progressive burial is observed in the Yosemite Slough Site. However, progressive burial processes have not consistently addressed PCBs and lead detections in several locations in the biologically active zone of the Site. During the remedial design stage, a data gap sediment sampling program of COC and COPCs (including organochlorine pesticides) will be investigated at specific areas of concern Sitewide to support the final remedy design.
20.	7-7	7.1.4	In situ treatment with activated carbon was not retained for further consideration because it is considered experimental in nature. However, this technology has advanced beyond the experimental phase. The EE/CA should summarize and consider the results of the activated carbon pilot testing performed in South Basin as part of the technology screening evaluation, and the information provided in EPA's "Use of Amendments for In Situ Remediation at Superfund Sediment Sites" (OSWER Directive 9200-2-128FS (April 2013).	The EE/CA, Section 7.1.4, was edited to remove the term "experimental" when describing in situ treatment using activated carbon.
21.	7-9	7.1.6	The site-specific evaluation of dredging should more specifically consider potential recontamination of the adjacent areas such as the planned wetland in Parcel E-2 at Hunters Point Naval Shipyard.	The EE/CA, Section 7.1.6, was edited to clarify that excavation near the eastern portion of the Yosemite Slough Site poses a potential risk of recontamination in adjacent areas.
22.	8-10	8.3	The text states that the MNR/EMNR may be implemented in areas where chemical concentrations are marginally above the remedial goals. These areas may also be candidates for in situ treatment with activated carbon.	For the reasons provided in the EE/CA, Section 7.1.4, in situ treatment was screened out due to concerns regarding long-term effectiveness of this technology for both PCB and lead contamination in the biologically active zone. However, it should be noted that the EPA edited the EE/CA Section 8.1.10 to allow design flexibility to allow the potential integration of activated carbon into a layer of the engineered cap.

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Written Comments from Bridgette DeShields, Principal Scientist, Integral Consultant, Inc. dated September 12, 2013				
23.		Introductory Section of Comment Letter	This letter provides comments on the Draft Engineering Evaluation/Cost Analysis, Yosemite Slough, San Francisco, California, Public Comment Draft dated July 2013 (the EE/CA) prepared by the U.S. Environmental Protection Agency (EPA) and Ecology and Environment, Inc. It is apparent that EPA has spent significant time and effort in evaluating site conditions, conducting technical evaluations, and reaching out to stakeholders throughout the development of the EE/CA. Considerable progress has been made in the last few years. In all, the document provides well-founded technical assessments, utilizes a multi-technology approach, which is appropriate, and includes a set of alternatives that is appropriate for evaluation in an EE/CA. EPA recognizes that additional work is necessary in the design process to further refine the preferred alternative prior to implementation, and we generally concur with this recommendation. However, as explained more fully below, we believe that Alternative 2 is the most appropriate and supportable remedy for this site. The comments below address both overarching issues in the document as well as more detailed comments on specific portions of the EE/CA.	The EE/CA selected Alternative 5 for the Site. Because Alternative 5 assumes a dredge volume deeper than the assumed protective engineered cap depth of 1 foot, cap thickness and associated dredge volumes under this alternative may be revised during the design phase once an updated understanding of the dredge boundaries, cap properties, Site hydrodynamics, and other design parameters are established and approved by the EPA. Reductions of the cap thickness under Alternative 5 will be allowed by the EPA only after evaluation of all pre-design studies and determination that all required Site RGs and RAOs can still be maintained with a high degree of long-term effectiveness.
24.		General Comment	The EE/CA mentions the need for source control (Section 3) and provides a brief summary on “Reasonable source control efforts underway or under consideration for the Site . . . .” No.1 on EPA’s list of eleven “Risk Management Principles Recommended for Contaminated Sediment Sites” is “Control sources early.” Contaminated Sediment Remediation Guidance for Hazardous Waste Sites at 1-5 (U.S. EPA 2005 OSWER 9355.0-85) (“2005 EPA Contaminated Sediment Guidance”). However, we are not aware of site-specific efforts under way for any of the listed items. Based on the observed quality of the surface sediments, it is likely that there are ongoing sources of contamination to the slough. These may be due, in part, to inputs from stormwater drainage and combined sewer overflow (“CSO”) events, as well as potential run-off from uncontrolled erodible sources, which are a potential source of contamination, at upland properties abutting the slough. Efforts in the near term should be undertaken to completely document the inputs from the sewer system and show scientifically, through careful evaluation of the loadings from the outfalls and modeling of the potential for recontamination, that the outfalls will not cause recontamination of the slough after the removal action. Equally important potential sources include local industries, erodible bank soils, and groundwater. These potential sources must be evaluated in the near term and if ongoing sources are confirmed, appropriate source control measures	The EPA agrees with this comment. The EE/CA, Section 3.2, discusses the scope of upland source control measures that are needed to be in place to protect the slough after the cleanup is complete. Slough bank stabilization (Section 8.1.1), CSO outfall modification (Section 8.1.2) and upland source control (Section 8.1.3) are integrated as part of Alternative 5, the selected response action for the Yosemite Slough Site. The EE/CA, Section 8.1.2, was edited to clarify those both chemical and physical impacts of the CSO outfalls may not be allowed to undermine the protectiveness of the selected response action. The EE/CA, Section 9.3, identifies the need for pre-design studies on these three elements plus a Site groundwater quality and flow study. In addition, land under control of the California State Lands Commission and CDPR located adjacent to the Site is now undergoing cleanup and restoration by the CDPR. During the Project design stage, the EPA will continue its efforts toward upland source control development

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			must be implemented before the start of any removal action. We are particularly concerned about the erodible bank soils, which are the responsibility of the particular property owners, because the banks of the slough are composed of the same industrial fill that likely present beneath in the slough and is a likely source of original contamination. Aside from the need for near-term efforts to confirm that adequate source control is in place to protect the investment in the removal action, additional efforts are warranted to coordinate the schedules of the other planned activities in the immediate vicinity including cleanup of the adjacent State Parks parcel and coordination with the U.S. Navy for the Hunters Point Parcel F cleanup.	and implementation. In addition, the EPA will work with its partners at the State (e.g. the Regional Water Quality Control Board [RWQCB]) to ensure appropriate Project sequencing and coordination between remediation work at the Yosemite Slough Site and adjacent areas (i.e. California State Parks Wetland Restoration and U.S Navy remediation of Parcel F-South Basin.
25.		General Comment	Costs presented in the EE/CA are inconsistent with those presented in the Fact Sheet and at the Public Meeting. Moreover, the costs presented are likely low due to optimistic assumptions and uncertainty about how the removal action would actually be conducted. It is acknowledged that the relative ranking of the alternatives in terms of cost is not likely to change and therefore, the selection process described in the EE/CA, in which cost is one factor, is not likely to change (but see General Comments 6–8 below). Nevertheless it is critical for EPA, the parties expected to fund the cleanup, and the public to have a reasonably accurate (for this stage in the process) idea of the anticipated cost of the removal action. Our independent estimate for Alternatives 2 and 5 suggests that the costs for these alternatives are likely to be at the higher end of the range presented, perhaps about $13,000,000 and $17,000,000, respectively. See Specific Comment 7 for more detail with respect to the estimate.	Based on these comments and all other comments concerning cost estimation, the EPA made several edits to the EE/CA's cost estimates for each alternative. Alternative 5, the EPA's selected response action, is now estimated to cost between $15.1M and $15.5M.
26.		General Comment	All of the alternatives evaluated, with the exception of the no-action alternative, meet the remedial action objectives (RAOs) provided in Section 6. Thus, any of the alternatives provide adequate protection of human health in the environment. The following are comments on the various alternatives: a. As demonstrated by the post-remedial calculations, most of the remedies are expected to achieve the numeric remedial goals immediately following remedy implementation with the exception of Alternatives 3 and 4, which rely on subsequent natural recovery processes. These alternatives likely would be equally effective to the preferred alternative, but we understand that EPA did not favor them due to current uncertainties associated with natural recovery processes in Yosemite Slough. However, EPA has retained some consideration of natural	The EPA has retained monitored natural recovery (MNR)/enhanced MNR (EMNR) in Alternative 5 for the reasons explained in the EE/CA. Although dredging and removal of exceedences of RGs remain an essential work element of Alternative 5, the EPA anticipates a complete evaluation and appropriate implementation of the other work elements included in Alternative 5 to maximize the timely and long-term protectiveness of each work element. Alternatives 6 and 7 were not selected by the EPA for the reasons provided in the EE/CA, Section 9.

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			recovery processes in the selected alternative and we agree that this is appropriate. Natural recovery processes are likely to occur at some level at least for portions of the slough and should be more thoroughly considered in the design process. See also General Comments 5 and 8 below. b. Alternatives 6 and 7 result in post-remedial concentrations well below the remedial goals; actions at this level are not warranted and also would have significant impacts on the surrounding community if implemented (e.g., truck traffic, noise, air quality, and other impacts). We agree that these alternatives should not be considered further. c. Alternatives 2 and 5 are both predicted to result in post-remedial concentrations below the remedial goals and thus are equally protective. In addition, following remedy implementation, the concentrations are likely to be even lower where natural recovery occurs. Alternatives 2 and 5, as discussed below, both rank similarly and are simply variations of the same alternative with differences in the depth of excavation tied to a conservative "margin of safety" beyond the biologically active zone (BAZ). The use of the margin of safety may result in an unnecessary increase in the cap thickness at a significantly higher and potentially unnecessary cost and additional community impacts. The thickness of the cap should instead be determined by the engineering and other design work that will be done prior to implementation of the remedy. The design work will determine the appropriate cap thickness and capping materials required to achieve a robust barrier that would provide any necessary margins of safety and meet the RGs. See General Comments 6 through 8 below.	The EPA selected Alternative 5 for the reasons explained in the EE/CA (see the EE/CA, Section 9.2.2). As stated in several places in the EE/CA, the final dredge depth in the portions of the Site where the biologically active zone exceeds remedial goals will be determined during the design phase and will be based on engineering factors, Site RGs and RAOs, and data developed during the design phase.

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<tr><td>27.</td><td></td><td>General Comment</td><td>The EE/CA utilizes site-specific data and risk evaluations conducted for Hunter’s Point Naval Shipyard (Parcel F, South Basin) sediments in developing remedial goals that meet the RAOs. We concur with this approach given that site-specific sediment characteristics are expected to be similar between South Basin and Yosemite Slough. In addition, habitat, exposure pathways, and receptor types are similar between the two areas. The site-specific evaluation of special status species provided in Appendix A of the EE/CA substantiates that the remedial goals for PCBs are also protective of species that may be present in the slough in the future (i.e., the California clapper rail). Furthermore, the Hunters Point risk assessment was reviewed by multiple stakeholders and regulatory agencies and approved by EPA through a rigorous multi-year process. Finally, the remedial goals are in the range of values used in the San Francisco Bay Area and nationwide. The following are some examples:

a. The lead remedial goal is the effects range median (ERM) value and has commonly been used as a remedial goal in San Francisco Bay and other sites within California, such as at the G&R Metals site in Eureka, California: http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T0602393235.

b. The PCB remedial goal is consistent with other cleanup goals in San Francisco Bay, such as Seaplane Lagoon with a cleanup goal for PCBs of 1.13 ppm: http://www.envirostor.dtsc.ca.gov/public/profile_report.asp?global_id=01970005&site_id=2002640.

c. The PCB remedial goal is also consistent with other goals used at other sites in the U.S., including the Koppers Pond Operable Unit of the Kentucky Avenue Wellfield Superfund Site in New York State (Draft Feasibility Study is currently in review with a cleanup goal for PCBs of 1 ppm). Other sites such as the Fox River and Housatonic River specify 1 ppm as the cleanup goal for PCBs.</td><td>The EPA agrees that similarities between the two sites support using data and risk evaluations from HPNS to develop remedial goals in this EE/CA. Please see the EPA’s response to Navy General Comment No. 2 for the EPA’s position regarding PCB RGs for the Yosemite Slough. However, the EPA notes that sediment RGs, including RGs for PCBs, can vary widely nationwide based on site-specific characteristics including habitat, exposure pathways, and receptor types.</td></tr>
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28.		General Comment	We understand that EPA has concerns about Monitored Natural Recovery (MNR) as a remedial technology on the grounds that currently there are insufficient data in the record to demonstrate that natural recovery is occurring now such that one could confidently model future rates of MNR in the Slough. However, analyses of the data from 1998 and 2009, as limited as the data might be, indicated that the concentrations of PCB and lead appear to have been reduced, in some cases up to about 70%, by ongoing natural recovery processes in the Slough. Just as EPA plans to gather additional data during the design phase to enable proper cap design - and, in effect, a choice between Alternatives 2 and 5—we recommend that EPA also collect data relevant to measuring rates of natural attenuation. If such data are gathered and one is able to model future rates of MNR with confidence, then it may well be appropriate to reconsider Alternatives 3 and 4 during the design phase. As pointed out in EPA's 2005 Contaminated Sediment and mentioned in Section 7.1.3 of the EE/CA, MNR is less disruptive to site ecology and has fewer short term impacts to the community than technologies that rely on sediment removal to achieve RAOs.	As described in the EE/CA, Section 9.2.1, Alternative 5, the selected response action, identifies the opportunity to integrate MNR/EMNR into the response action design. As described in the EE/CA, Section 9.2.1, the MNR/EMNR will be considered to address portions of the Site where the biologically active zone is only marginally above RGs. As the commenter points out, Alternative 5 effectively integrates MNR/EMNR into the selected response action for significant portions of the Site where the biologically active zone already meets RGs. Alternative 5 requires monitoring of the BAZ Site-wide to ensure RAOs and RGs are achieved immediately after the construction phase of the Project and in the long-term. The final scope and role of MNR/EMNR will be determined during the response action design phase.
29.		General Comment	Alternatives 2 and 5 both have an overall "high" score in Table 9-1. This is based on the fact that both alternatives meet all RAOs and achieve the same post-removal action area-weighted averages (AWAs) of 123 mg/kg for lead and 315 µg/kg for PCBs. The functional difference between the alternatives is in dredging volume (5,900 CY vs. 10,700 CY), and, of course, the related differences in cost, duration, and short-term negative impacts. Assuming, as we should at this point, that an effective cap can be designed to isolate the sediments below 1 foot as would be needed for Alternative 2, there is no compelling reason to select Alternative 5, particularly because its selection will not achieve any greater effectiveness in achieving the RAOs over Alternative 2. Moreover, because of its additional dredging volume, Alternative 5 will impose greater short-term impacts on the community because it will generate double the number of trucks and result in a longer construction duration than Alternative 2.	The EPA generally agrees with this comment with some important exceptions. The EE/CA, Section 9.2.2, explains that Alternatives 2 and 5 obtain the best overall ranks compared to the other alternatives. The EPA recommends the selection of Alternative 5 due to its potential to provide more certainty with respect to long-term effectiveness compared to Alternative 2. However, these alternatives are similar, varying mostly in the assumed thickness of the engineered cap. As described in Section 8.6, Alternative 5 assumes a deeper dredge depth than the assumed protective engineered cap thickness of 1 foot in Alternative 2. Thus, cap thickness and associated dredge volumes under Alternative 5 may be revised during the design phase once updated understandings of the dredge boundaries, cap properties, site hydrodynamics, and other design parameters are established and approved by the EPA. Reductions of the cap thickness under Alternative 5 will be considered by the EPA after evaluating pre-design studies and determining that

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				required Site RGs and RAOs can be attained and maintained with a high degree of certainty for long-term effectiveness.
30.		General Comment	The selection of Alternate 5 is contrary to the requirement that a remedy be cost effective. Section 121(a) of the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA"), concerning cleanup standards, states as follows: The President shall select appropriate remedial actions . . . which provide for cost-effective response. In evaluating the cost effectiveness of proposed alternative remedial actions, the President shall take into account the total short- and long-term costs of such actions, including the costs of operation and maintenance for the entire period during which such activities will be required. 42 U.S.C. § 9621(a); see also 42 U.S.C. § 9621(b)(1) ("The President shall select a remedial action . . . that is cost effective."). EPA's Guidance on Conducting Non-Time-Critical Removal Actions under CERCLA (PB93-963402, August 1993) ("Removal Action Guidance") cites the cleanup standards set forth in CERCLA Section 121. See Removal Action Guidance at 44. The Removal Action Guidance recognizes that "[a]n EE/CA serves an analogous function, but is more streamlined than the RI/FS conducted for remedial actions." *Id.* at 20. Thus, it is appropriate to look to the requirements for a Remedial Investigation/Feasibility Study ("RI/FS") when evaluating an EE/CA for a removal action. That is especially the case when considering the factor of cost; after all, the name of the operative document is "Engineering Evaluation/Cost Analysis." The National Contingency Plan (the "NCP") is quite clear on this point. Section 300.430 of the NCP requires that each remedial action selected through an RI/FS be cost-effective. See 40 CFR 300.430(f)(1)(ii)(D). Cost effectiveness is determined by comparing overall effectiveness to cost. *Id.* The NCP further states that "[a] remedy shall be cost-effective if its costs are proportional to its overall effectiveness." *Id.* Based on EPA's own evaluation as summarized in Table 9-1, both Alternatives 2 and 5 have an overall "high" score based on effectiveness and implementability. However, EPA's cost estimates	The EPA disagrees that Alternative 2 is more cost-effective than Alternative 5. The EE/CA, Section 9.2.2, provides information that explains why Alternative 5 provides greater certainty in achieving long-term effectiveness than Alternative 2. Without first ensuring effectiveness, cost-effectiveness cannot be ensured. Alternative 5 also contains the flexibility to attain maximum cost-effectiveness during the design phase. The commenter must remember that the EPA places great importance on long-term effectiveness in this EE/CA and will continue to do so in the design phase. Alternative 2 does not include the flexibility to confirm optimum long-term effectiveness to achieve maximum cost-effectiveness during the design phase.

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			for Alternate 5 are more than $4 million more (or 40% to 50% more, depending on dredging method), than the cost estimates for Alternate 2, without a corresponding increase in effectiveness, and thus under the NCP standard quoted above, Alternate 5 is not as cost effective as Alternative 2.	
31.		General Comment	Based on General Comments 6 and 7 above, we disagree with EPA's preference for Alternative 5 and suggest that Alternative 2 is the more appropriate alternative based upon the EE/CA and NCP selection criteria. We further suggest that EPA, at a minimum, clearly state the similarity of Alternatives 2 and 5 and make clear that Alternative 5 has higher cost and community impact with no commensurate benefit in effectiveness. Given the selection of a capping remedy, the design process should dictate the final decision on the cap material and thickness, and thus removal volume, as well as the shape and size of the polygons for removal and methods for remediation. Furthermore, if natural recovery processes are favorable, based on additional studies conducted during design, Alternatives 3 and 4 could be reconsidered or MNR/EMNR could be more significantly relied upon for the selected alternative and in refining the areas subject to dredging and capping, as discussed in General Comment 5.	Comment Noted. Alternatives 3 or 4 cannot be implemented at the Site without formal EPA modification to the EE/CA and associated Action Memorandum.
32.		Specific Comment, Section 2.1	While the general description of the Site provided here is sufficient to orient the readers of the EE/CA, this language should be clarified. We recommend inserting language following the first sentence in the second paragraph of Section 2.1 that states as follows: "Thus, the western and southern boundaries of the Site are defined by the current MHWL, while the northern and eastern boundaries of the Site exclude the CDPR's restoration areas. These boundary lines will be properly surveyed as a part of future work." We also concur that the definition of the Site includes suitable areas in proximity to the Site where it is necessary to implement the cleanup response action. See 40 CFR 300.5. These areas could include sediment dewatering and other areas necessary for remedy implementation.	The EE/CA, Section 2.1, was modified to address this comment and other comments concerning Site ownership.
33.		Specific Comment, Section 2.4	Description of geology in Yosemite Slough is inaccurate because it does not clearly state that fill exists within the slough as well as on the banks. As written, the draft EE/CA implies that the contamination came to exist within the slough as a result of water transport and typical sedimentary processes, which is inconsistent with the site conceptual model. Rather, it should explain that the site geology includes a layer of industrial fill placed	The EPA believes that the EE/CA, Section 2.4, adequately identifies potential mechanisms for Site contamination. No changes were made to the EE/CA due to this comment. However, the Site conceptual model will continue to be modified as additional Site data is evaluated during the remedy

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			in the 1940s. This layer, rather than any truly sedimentary layer, likely contains the majority of the inventory of the constituents of interest.	design phase.
34.		Specific Comment, Section 3.2	The cleanup planned for the State Parks property should be listed as source control measure. Fill soils containing contaminants are present on the State Parks property south of the slough. Also, all available data for that property should be added as an appendix to the EE/CA, including all data submitted to the Regional Water Quality Control Board.	The EE/CA, Section 3.2, lists the State Park Wetlands Restoration Project as an on-going source control effort in relation to the Site cleanup selected in the EE/CA. The EPA disagrees that data generated for State Parks under the RWQCB Order for the Wetlands Restoration Project should be added as an appendix to the EE/CA. Please direct your request in this matter to the RWQCB as they are the lead regulatory agency for the State Parks project at Yosemite Slough.
35.		Specific Comment, Section 4.2.2	In the second full paragraph on page 4-4, the third sentence states that an 18-inch margin of safety may be needed to protect bat rays. However, the remedial goals are designed to be protective of all aquatic life. Nonetheless, based on the second part of that sentence that discusses burrowing marine animals, it is assumed that the issue being addressed is bioturbation. We agree that bioturbation and the depth of the BAZ should be addressed in the design of the cap. We also understand that the 18-inch margin of safety was added to allow for uncertainties associated with the depth of bioturbation as well as other factors, including erosion and scouring. It is, therefore, recommended that this sentence be deleted and replaced with the following sentence after the sentence beginning “During the design stage…” “A number of factors will be considered in design, including the depth of bioturbation, erosion, and scouring within the slough, and other types of disturbance that could impact the long-term performance of the selected remedy.” Furthermore, as discussed in General Comment 3, the margin of safety is a conservative relatively arbitrary designation and is driving the selection of Alternative 5 over Alternative 2. The design performed in advance of the implementation of the remedy will dictate the necessary thickness and composition of the cap, including accounting for a margin of safety, at various locations at the site.	The EPA believes the current text about the potential for bat ray burrows is appropriate. The EPA disagrees that the 18-inch margin-of-safety is overly conservative at this point in the response action development process (i.e. pre-design). The EPA inserted the suggested sentence in the EE/CA, Section 4.2.2.
36.		Specific Comment, Section 6.2	In the third sentence of the last paragraph, delete the words “where exposure and risk may occur.” Exposure and risk would only occur in the BAZ, which is currently defined as 6 inches.	The EE/CA, Section 6.2, was edited as suggested.
37.		Specific Comment, Figure 8-3 and 8-6	Polygon YC-018 is included in the remedy for Alternatives 2 and 5, but it does not meet the criteria for inclusion. The lead and PCB concentrations in the 0- to 1-foot interval are below the not-to-exceed remedial goals. Either	Polygon YC-018 was found to be below the NTE RGs and was removed from the dredging volume of Alternatives 2 and 5.

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			this point should be excluded from the remedy or a reason provided for its inclusion.	
38.		Specific Comment, Table 9-1	Cost estimates presented in this table do not match those presented in EPA's Fact Sheet. The costs in Appendix G, which form the basis of Table 9-1, should be rechecked for applicability and accuracy and a consistent set of costs developed for the EE/CA and Fact Sheet. One particular concern is the cost for hydraulic controls presented for the mechanical and hydraulic dredging variations in each alternative. In the case of the mechanical dredging variation, a cost of $1,818,000 for a cofferdam is described as follows: "Soldier beams & lagging H piles with 3" wood sheeting horizontal between piles, including removal of wales and braces, no hydrostatic head, 36' – 45' deep with 4 lines of braces, 14" H. Includes Material, Labor and Equipment Costs. Depth needed is based on the Geotechnical study results. Assume length needed is 1000' across the mouth of the Slough and a depth of 36 feet." However, the text in Section 7.1.6 states that: "Mechanical dredging 'in the dry' involves excavation of sediment after isolating the sediment from the water column using water control structures, such as berms or steel sheet pile walls to divert the water from the excavation area. The area would be isolated using one or more of the following technologies: sheet piling, earthen dams, cofferdams, geotextile tubes, and inflatable dams. The feasibility and cost of hydraulic isolation of the dredging area during remediation is a major factor in selection of dredging in the dry. Once isolated, standing water within the excavation area would be removed by pumping. Any continuing inflow due to seepage from groundwater or through the water control structures must be managed throughout the process, typically by automated pumping systems." These two descriptions are in conflict because the description in Section 7 calls for hydraulic control but the text in Appendix G disclaims the ability to allow achievement of a differential hydraulic head. Similarly confusing is the fact that the hydraulic dredging estimates in Appendix G do not	The EE/CA has been revised so that the cost estimates referred to in the text match the cost estimates identified in the cost tables. The cost estimates for several line items were adjusted to address this comment and other comments concerning the costs estimates presented in the EE/CA. Ultimately, the relative cost difference among alternatives did not change significantly and the rationale for the selection of Alternative 5 is provided in the EE/CA, Section 9.2.2.

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			include the same $1,818,000 cofferdam line item as in the mechanical dredging estimates, but rather a $410,000 line item for a cofferdam of unspecified type and dimensions (based upon an unsupported quote from JND Thomas). We believe that hydraulic dredging would have as much, if not more need for hydraulic control within the slough during the work. Perhaps most importantly, the feasibility of any cofferdam to control the water level in the slough was put in question by ARCADIS's May 2012 Geotechnical Data Report[1]. The variable thickness of the sediment layers and the presence of bedrock at highly variable depths led the authors of that report to conclude: "A relatively simple cofferdam may consist of a cantilever sheet pile structure. Cantilever sheet pile structures rely on embedment into subsurface materials for stability. Because sheet piles cannot be driven into bedrock, a minimum thickness of sediment or soil is required above bedrock to achieve stability. The required thickness of sediment/soil depends on the strength of the subsurface material and the loading conditions. A cantilever sheet pile structure may be feasible if the following conditions exist: • Relatively small lateral loading from earth pressures, hydrostatic pressure, and wave loading • Sufficient sediment/soil thickness above bedrock to allow for sufficient embedment of the sheet piles to develop lateral resistance • Subsurface sediment/soil that consists of sufficiently competent material and that is not too dense/hard to allow for penetration of the sheet piles during driving. Based on the geotechnical subsurface information presented herein, at least the latter two of the above conditions will present significant challenges in some areas of the site. More specifically, the following conditions present significant challenges for the	

[1] http://yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/3dc283e6c5d6056f88257426007417a2/b1e773eba9c0667188257abb006c57d8/$FILE/Geotech%20Data%20Report_Yosemite%20Slough.pdf

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			design and installation of a cantilever sheet pile cofferdam: • Highly variable bedrock surface elevation (sheet piles cannot be driven into the bedrock) and associated highly variable sediment thickness available for sheet pile embedment • Significant thickness of low-strength material in the upper sediment profile As a result of the above conditions, a cantilever wall may only be feasible in some areas (i.e., in the areas where the bedrock surface is relatively deep below the sediment surface along the entire wall alignment). The feasibility and challenges of installing a sheet pile cofferdam will depend greatly on the location of the cofferdam. Shallow bedrock (approximately 20 feet below sediment surface at boring location AUS-B-05) exists near Double Rock in South Basin (refer to Figures 2 and 4). A cofferdam alignment relatively close to Double Rock likely would require a combination of a cantilever system and a laterally supported system (e.g., a sheet pile structure laterally supported by drilled batter piles embedded in the bedrock). A relatively short cantilever sheet pile cofferdam directly at the mouth of the slough, where the depth to bedrock is much deeper (refer to Figure 3) or within the slough may be possible. Cofferdam structures other than a sheet pile structure (e.g., gravity structures or earthen berm) have not been evaluated but may also be affected by the presence of very soft to soft, highly compressible Young Bay Mud. For relatively small removal areas, it may not be necessary to install an elaborate cofferdam structure. For small areas, excavation at low tide may be feasible or a Portadam structure (www.portadam.com), which can be used in open water up to 10 feet deep, could be considered to keep water out of the excavation. Based on the water depths at the site, this approach may be feasible for a variety of potential cofferdam	

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			alignments." Given the fundamental feasibility questions surrounding a cofferdam and the ability to control water level in the slough, we believe that EPA should consider dredging and capping approaches that can be accomplished without complex or excessively expensive hydraulic/turbidity controls. For the purpose of cost estimating, we suggest use of a $1,000,000 uniform placeholder for hydraulic/turbidity controls. If a cofferdam is actually required to perform the work, which we do not believe is the case, costs could approach $3,000,000 for this item alone. In addition, the costs for design and construction management have likely been underestimated. Construction management should be closer to 10% (5% is assumed now). Pre-design studies, design, and other studies and work plans to support compliance with ARARs and implementation are likely to range between $1,500,000 and $2,000,000.	
39.		Editorial Comment, Section 2.1	Please revise the second sentence of the first paragraph to add "when irregular/margin areas are included in the total square footage." Please provide a citation/reference for the quotation in the 3rd paragraph. In the 4th paragraph, revise the first sentence to read "In addition, there are areas in proximity to the Site that are suitable for use as staging areas, materials handling areas, and other activities necessary to implement the cleanup response action." In the second sentence of the 4th paragraph, delete the words "to be considered." Additionally, please add an acknowledgement that a formal survey will be needed to establish the official boundaries of the site.	The EE/CA, Section 2.1, was edited to address this comment and other comments concerning Site ownership.
40.		Editorial Comment, Section 2.11	Please provide literature citations for the information provided in this section.	The EE/CA, Section 2.11, was supplemented with a literature citation.
41.		Editorial Comment, Table 3-1	Please add definitions of all acronyms to the table.	Table 3-1 of the EE/CA was modified as requested.
42.		Editorial Comment, Table 3-2	The title of the 7th column of the table should be "Maximum Site Concentration (2009-2012)." Please add definitions of all acronyms to the table.	Table 3-2 of the EE/CA was modified as requested.
43.		Editorial Comment, Section 3.3.1	Please make the following changes: a. Second full paragraph: "BPTCP" is misspelled. Please correct. b. Third full paragraph: insert "for all COPCs" after the word "calculated" in the last sentence.	The EE/CA, Section 3.3.1, was modified as requested.

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			c. Second bullet after third full paragraph: please rewrite to read "The 95% upper confidence limit (UCL) of the mean is defined as the 95% upper confidence limit on the average as calculated using ProUCL 4.1.00 (EPA, 2010); and . . . ."	
44.		Editorial Comment, Section 3.3.3	Add the word "sitewide" before 95% UCL in the first sentence.	The EE/CA, Section 3.3.3, was modified as requested.
45.		Editorial Comment, Figure 8-8	Alternative 7 includes removal of sediments up to 4 feet below sediment surface). Figure 8-8, however, has a label for a 5-foot removal. This label should be deleted from the legend.	Figure 8 of the EE/CA was modified as requested.
46.		Editorial Comment, 9.3	In addition to the design studies listed in Section 9.3, various surveys, work plans and implementation plans (including but not limited to site surveys, air/dust/community monitoring plans, traffic management plans, soil management plans, etc.) will be required. Some text should be added regarding the need for these components.	The EE/CA, Section 9.3, was modified as requested.
47.		Editorial Comment, Appendix B	Please include all available aerial photos.	Appendix B already includes all aerial Site photos appropriate for this EE/CA. No changes were made.
Written Comments from Amy Brownell, San Francisco Department of Public Health dated September 13, 2013				
48.		Comments on the Proposed Plan Fact Sheet	Table One: The heading states that the units are parts per billion but the lead concentrations are listed in parts per million. Please revise. Table Two, Sediment Dredging, Summary of EPA Conclusions Concerning the Use of Technology at Yosemite Slough, second to last sentence: Please remove the phrase "which would likely be located in the Candlestick Park overflow parking lot" since the dewatering location will be decided in the Remedial Design. If you prefer to keep the phrase then change from "would likely" to "may".	The EPA agrees that there was a typographic error concerning the units listed in Table 1 of the Proposed Plan. However, the EPA believes that this error did not significantly impact the general public's understanding of the EPA's Proposed Plan. This error did not occur in the EE/CA. Regarding the comment concerning Table Two of the Proposed Plan, the EE/CA was modified to clarify the two location options for sediment processing: the Candlestick Park Overflow Parking Lot immediately southeast of the Site and the SF Port facility about 2 miles north of the Site.
Comments on the Draft EE/CA				
49.		General Comment	Dewatering locations and transportation to landfills: Please add figure(s) similar to the ones used for the Proposed Plan and public meeting that illustrate the dewatering locations and truck haul routes to landfills. The attached are two versions that might be appropriate. Figure 3 from the Proposed Plan could also be used. The text will need to point out that the rail transportation option will be different and follow the existing rail lines.	The EE/CA, Figures 7-1, 7-2, and 8-2, were modified to clarify the locations and haul routes to/from the potential sediment processing locations.

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50.	7-12 and 7-13	7.1.7	Management and/or Treatment of Contaminated Material bottom of pages: Please change the reference from "Pier 96" to "SFPort Facilities". There are several piers in that area that might be used and the exact location won't be decided until the Remedial Design or Remedial Action Phase.	The EE/CA, Section 7.1.7, was modified as requested by this comment.
51.	7-12 and 7-13	7.1.7	Management and/or Treatment of Contaminated Material: The text at the bottom of 7-12 and 7-13 describes the possibilities for the two potential dewatering locations and transportation to and from those locations. Additional text should be added to Transportation/Disposal on 7-13 to continue to emphasize these possibilities. Here is some possible wording – please edit as necessary. Pipeline: you could add a sentence as follows: The pipeline from the hydraulic dredging barge to the Candlestick Park Parking Lot would be approximately X feet long. Alternatively, a pipeline from the hydraulic dredging barge to SFPort Facilities would have to be placed underwater and extend around the Hunters Point Shipyard property and be Y feet long. Truck: Before the last sentence please add: "To transport dried sediments from the Candlestick Park Parking Lot dewatering area,". Then add another sentence: "Trucks would travel on roads shown on Figure X to travel from SFPort Facilities to off-site disposal landfills." Barge: Please modify the second sentence or add another sentence: "Dredged sediments could be placed in barges and transported to either the nearby Candlestick Park Parking Lot facility or the barge could travel around Hunters Point to the SFPort Facilities." Railcar: Suggest modifying to read: Rail spurs could be constructed to link the Candlestick Park Parking Lot staging area to the existing rail network. Operational rail access already exists at the SFPort Facilities to transport sediments to off-site disposal landfills.	The EE/CA, Section 7.1.7, was modified as requested by this comment.
52.		8.5, Alternative 4	Remove Sediment in the Top 1-foot Interval Where COCs Exceed Three Times RGs (with two exceptions): EMNR/MNR, Engineered Cap or Backfill, and ICs – third sentence: Shouldn't the sentence start with "Two" not "Three"?	The EE/CA, Section 8.5, was modified as requested.
53.		Appendix G	Appendix G Cost Estimates, General Comments: Please see the attached spreadsheets that provide specific comments on the cost estimates for each alternative. In general, the comments on the spreadsheets were written once (usually for Alternative 2) and should be applied as appropriate to all the alternatives. In addition some summary observations are:	The EPA modified the EE/CA, Appendix G, to address these comments and other comments concerning cost estimates for each alternative. As a result, costs estimates for each alternative increased. The cost estimate for Alternative 5, the

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			• The production rates are greatly overestimated, creating a much shorter schedule and lower overall price. The production rates are based on a terrestrial project with open space, without dewatering, without waste management, a long haul road, a detailed cap placement, etc. Please consider a complexing factor, or scaling factor where all RS Means production rates are cut to 15%. • The dewatering component is underestimated. An example is a comparison of the dewatering plan for the full excavation vs. Alternative 2. They are within 15% of each other. We think the water volume will probably be 5 to 50 times the volume currently listed. • The Hydraulic Dredge assumes ALL of the Slough will be dredged. There is an area in the north where we think the dredge will never be able to enter. The costs for hydraulic dredging should include a component of hydraulic dredging and mechanical excavation for these inaccessible areas. • Overall, considering these issues, an increase in cost estimates of 20 to 30% may not be unreasonable.	selected response action, now ranges between \$15.1M and \$15.5M.
54.		Appendix G	Appendix G Cost Estimates, Contaminated Sediment Removal and Transportation and Disposal of non-hazardous sediment: The pipeline, truck, barge and railcar costs associated with the SFPort Facilities do not appear to be included in the cost estimates. The pipeline and/or barge cost should be significantly higher for the SFPort Facilities option. However, the transportation to off-site disposal landfills by railcar should be significantly less expensive than transportation by truck. It might be advisable to include two different set of costs depending on which staging/dewatering area is chosen. Alternatively, since the most significant cost in these categories is the approximately \$920,000 cost of transportation, if you went ahead and calculated the difference between using the two dewatering locations and found it to only reduce the overall cost of this subset of items by less than half (this is a guess) then you could add footnotes to the cost estimate pages stating that the costs shown are calculated for the Candlestick Park Parking Lot site and therefore the EE/CA is illustrating the highest “worst-case” scenario (for these subset of tasks) and any reduction in cost because of selection of the SFPort Facilities would still be within the minus 30% margin allowed for the	The EPA did not modify the cost estimates in Appendix G to account for cost differences if the alternative sediment processing area (SF Port Facility) is ultimately selected. At this time, the EPA agrees that the increased costs to transport dredged sediment to the SF Port facility will be offset to some degree due to access to rail facilities. The exact cost impact of processing sediments at the SF Port facility and using the associated rail facilities are unknown at this time. If the alternative sediment process area is selected during the design stage, the EPA will re-assess the cost implications of such a decision and modify the CERCLA decision documentation, if necessary, in compliance with CERCLA regulations.

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			EE/CA. If you chose this footnote option then you might want to add a footnote to all the summary cost tables to this effect.	
55.		Appendix G	Appendix G Cost Estimates, Miscellaneous comments • Mobilization construction kick-off meetings should include a comprehensive site safety review • What is a normal construction day? Excavate during low tide and backfill during rising tide? • We could not identify any work tasks or project costs or contingency events for EMNR. Can you clarify if EMNR unit costs are included in any tasks?	The EE/CA cost estimates in Appendix G do assume mobilization kick-off meetings and daily safety meetings. The prime contractor will be responsible for establishing a site health and safety plan prior to field activities, and all subcontractors will be required to adhere to that health and safety plan. Ten-hour days are assumed for each construction day and tidal cycles were not considered. This level of Project planning and cost estimation will occur during the Project design phase. For purposes of this EE/CA, the EPA did not include an increment for the thin layer cover element of the EMNR. Alternative 5 includes MNR/EMNR and the scope of this technology will be determined during the design phase. At this time, adding a cost increment for the EMNR was determined unnecessary as the scope and associated costs for a thin layer cover, if any, is not considered to be significant.
56.		YOSEMITE SLOUGH EE/CA COMMENTS ON COST ESTIMATING SHEETS; G6:Alternative 4	Cut and chip trees: The task has 2 acres, where most other tasks use a quantity of only 1 acre. Grub Stumps and remove: The task has 2 acres, where most other tasks use a quantity of only 1 acre. Strip Topsoil: The task has 807 cubic yards, while the other alternatives uses only 404 cubic yards Gravel for Haul roads: The task has 807 cubic yards, while the other alternatives uses only 404 cubic yards Bank Treatment Backfill: The task has 928 cubic yards, while the other alternatives uses only 465 cubic yards	The EPA modified the EE/CA, Appendix G, so that estimated quantities were consistent for all alternatives as appropriate.
57.		YOSEMITE SLOUGH EE/CA COMMENTS ON	Dewatering: I would like to challenge the dewatering assumption that the amount of additional water is directly proportional to the amount of	Thank you for providing detailed comments concerning specific individual line items in the

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		COST ESTIMATING SHEETS; G8: Alternative 5	additional sediment removed. In this scenario, excavation of portions of the Slough will extend to 2 feet. I believe there should be a higher multiplier factor in these isolated excavation areas. The general dewatering task is almost identical to the 1-foot excavation plan. Dewatering: Also, I recommend additional temporary sheeting or shoring boxes to isolate the limited vertical excavation areas and to minimize cave-in of the sidewalls. Treatment of the Dewatering Water: The water treatment task is almost identical to the 1 foot excavation, which exemplifies an underestimation of the volume of water.	cost estimates. The EPA did not modify the cost estimates in Appendix G based on this comment. For the purposes of the EE/CA, the EPA determined that addressing these comments would not significantly change the cost range of each alternative or change the EPA's selection of Alternative 5. Additional details and refinement of the costs will occur during the design phase.
58.		YOSEMITE SLOUGH EE/CA COMMENTS ON COST ESTIMATING SHEETS; G10: Alternative 6	Cut and chip trees: The task has 2 acres, where most other tasks use a quantity of only 1 acre. Grub Stumps and remove: The task has 2 acres, where most other tasks use a quantity of only 1 acre. Strip Topsoil: The task has 807 cubic yards, while the other alternatives uses only 404 cubic yards Gravel for Haul roads: The task has 807 cubic yards, while the other alternatives uses only 404 cubic yards Bank Treatment Backfill: The task has 928 cubic yards, while the other alternatives uses only 465 cubic yards	The EPA modified the EE/CA, Appendix G, so that estimated quantities were consistent for all alternatives as appropriate.
59.		YOSEMITE SLOUGH EE/CA COMMENTS ON COST ESTIMATING SHEETS; G3: Alternative 2	Overlapping tasks: The majority of the comments associated with task G-3 may be derived from Task G-2. Overlapping tasks: The hydraulic dredge option assumes the work will proceed faster and save at least 1 week. I would like you to review the assumptions and project plan to confirm this is true. The dredging will remove material faster, and allow easier access in the deeper water. However, in the northwestern portion of the Slough, you will probably have to go with mechanical excavation and dewatering without an extensive bulkhead. This work will increase time and costs. Surveying Crew: The surveying will integrate both standard terrestrial surveying and hydrographic surveying for the dredge operator. It will be crucial for the dredge operator to include the correct water elevation and the sediment surface to avoid over dredging.	The EPA did not modify the cost estimates in Appendix G based on this comment. For the purposes of the EE/CA, the EPA determined that addressing these comments would not significantly change the cost range of each alternative or change the EPA's selection of Alternative 5. Additional details and refinement of the costs will occur during the design phase

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			Site Prep: Dredge mobilization appears high. Can you expand in your assumptions the size of the dredge, the power system for the dredge and the location guidance system? I would believe a 6-inch cutter head dredge with an 8-inch discharge pipe would be sufficient for the project. Sediment Removal: I understand the hydraulic dredge is based on a quote, however it seems out of place that mobilization will be more expensive than hydraulic dredging. Sediment Removal: The volume of hydraulic dredge material is over estimated. The estimate assumes ALL of the material will be removed with a hydraulic dredge, which is impractical. At least 15% of the material will be mechanically excavated because the area dries out so frequently. Cofferdam Construction: I recommend you expand the description and definition of the smaller coffer dam. The costs are approximately 1/4 of the comparable costs for the Mechanical removal but I would assume the alternate coffer dam would be shorter and shallower with a possibly greater cost deduction. Assumptions: Assumption 12 assumes the coffer dam will be 36-feet deep x 1,000 feet long. I believe this is a typo and should be substantially shorter and potentially more shallow. Sediment Dewatering: The fully saturated dredge material may have a water content as high as 75%. The sediment dewatering costs do not include a larger fluid management plan. The wet solids from the 8-inch discharge pipe need to be routed to a wet sludge collection system that may include several additional frac tanks or a larger modutank system. Treatment System Dewatering: The water treatment system for the hydraulic alternative must be substantially larger. An 8-inch hydraulic dredge will maintain a constant flow over 300 gpm, in order to maintain the solids in a fluidized state. This is substantially larger than the mechanical dewatering system. Batch Discharge: The Hydraulic Dredging option adds only 70,000 cubic feet of water to the discharge plan. This does not correspond with the assumptions of 267% more water, nor does it agree with my evaluation that the volume of water will be orders of magnitude greater.	

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			Capping Installation: The capping plan must be amended to account for the hydraulic dredge area. The unit price assumes dumped installation and spreading with a dozer. Construction Management: I recommend you add an additional 1% of the project for marine management and marine communication for the hydraulic dredging activities. This will include hydrographic surveying during the hydraulic dredge operation. Equipment Demobilization/ Decontamination and Project closeout: I recommend we define if we are going to decon the 8-inch plastic discharge pipe, or if we are going to dispose of the material. Also we should review and describe how to decon the dredge, which will take additional time and costs. Timber Crane Mat Rental AND Relocation: I believe Timber Crane mats will be required for the northwestern section of the Slough and I would recommend 50% of the materials for the mechanical dredging. I recommend you dedicate 1 operator and 2 laborers for the entire project period for the crane mat movement. Construction Mobilization and Demobilization: If you agree at least a portion of the Slough must be mechanically excavated, we need to add back mechanical soil handling and trucking under this task.	
60.		YOSEMITE SLOUGH EE/ CA COMMENTS ON COST ESTIMATING SHEETS; G4: Alternative 3	Overlapping tasks: The majority of the comments associated with task G-4 may be derived from Task G-2. Monitored Natural Attenuation: I recommend you add a description of the MNA tasks in the assumptions. Monitored Natural Attenuation: I recommend we include some contingency plan and contingency costs within any alternative that includes MNA.	The EPA did not modify the cost estimates in Appendix G based on this comment. For the purposes of the EE/CA, the EPA determined that addressing these comments would not significantly change the cost range of each alternative or change the EPA's selection of Alternative 5. Additional details and refinement of the costs will occur during the design phase
Written Comments from Cy R. Oggins, Chief, Division of Environmental Planning and Management, California State Lands Commission dated September 13, 2013				
61.			Thank you for the opportunity to review the subject EE/CA for the Yosemite Slough removal action for contaminated sediment (Project). The California State Lands Commission (CSLC) staff supports the planned removal action for contaminated sediment in Yosemite Slough, also known as the "Yosemite Creek Sediment Superfund Site" (Site). The CSLC is a	Thank you for your comment and support of the EPA's selected response action alternative.

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			trustee agency for projects that could directly or indirectly affect sovereign lands and their accompanying Public Trust resources. CSLC staff has reviewed the draft EE/CA and has the following comments.	
62.	2-1	Figure 2-1	Site Location and Description Page 2-1 of the EE/CA states the following: "As shown on Figure 2-1, the south, west and north sides of the Site are contiguous with the Candlestick Point State Recreational Area (CPSRA), which is owned or operated by the California Department of Parks and Recreation (CDPR) and the California State Lands Commission (CSLC)." This sentence is inaccurate and should be revised for the following reasons: (1) Figure 2-1 lacks sufficient detail to identify the property contiguous to the Site. (2) At the present time, the CPSRA does not completely surround the north, south, and west sides of the Site. (3) Whether the CPSA will completely surround the north, south, and west sides of the Site in the future depends on the occurrence of future land conveyances. (4) The CSLC is not an operator on any of the land contiguous to the Site and has no plans to be an operator on such land in the future. CSLC staff requests that the EE/CA be revised to further clarify the jurisdiction of the CSLC both in the text and on Figure 2-1.	The EE/CA, Section 2.1, was modified to address this comment and other comments concerning CPSRA and Site ownership.
63.	8-17 9-5	8.6 9	Recommended Alternative Please provide the correct assumed dredge volume for Alternative 5 (the EE/CA provides two different volumes). • In Section 8.6 (page 8-17), the EE/CA states: "For purposes of evaluation of Alternative 5, a dredge volume of 10,700 CY [cubic yards] will be assumed with the understanding that the final dredge volume may be reduced or increased during the design stage." This dredge amount is also reflected in Table 9-1. • In Section 9 (page 9-5), the EE/CA states: "Alternative 5 includes a dredge volume of 14,400 CY, the final dredge volume may be reduced or increased during the design stage."	Sections 8.6 and 9.0 of the EE/CA were modified so that the revised estimated dredge volume was consistently presented for Alternative 5.
64.			Cost Analysis	Comment acknowledged and noted. The EPA has

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			As noted above, CSLC staff supports the planned removal action for the Site; however, due to budgetary constraints of both State and Federal agencies, staff is concerned that the estimated costs for the Project will render the Project infeasible. For this reason, staff suggests that the EE/CA include a discussion of how the Project will be funded to provide a realistic approach to moving forward.	selected Alternative 5 which is estimated to cost between $15.1M and $15.5M. EPA believes that Project funding can be obtained with the full participation of the potentially responsible parties identified for the Site.
Written Comments from Elizabeth Goldstein, President, California State Parks Foundation, dated September 13, 2013				
65.			On behalf of the California State Parks Foundation and our 130,000 members statewide, I am writing to comment on the above referenced EPA plan to clean up Yosemite Slough. The California State Parks Foundation is the only statewide non-profit membership organization dedicated to protecting, enhancing and advocating for California's 280 natural, cultural and historic state parks. Over our 40-year history, we have supported the stat park system by raising more than $186 million to support park programs and projects and have worked to protect countless natural, cultural and historical treasures found within our parks. On behalf of our members, we are committed to ensuring that state parks continue to provide recreation, adventure, renewal, and inspiration to all Californians. In partnership with California State Parks, we have been the project lead to raise the $30 million needed to help transform Candlestick Point State Recreation Area (CPSRA) into a model urban park. CSPF secured $14.3 for the first and most ambitious phase of this project, restoration of the north side of Yosemite Slough at CPSRA, which broke ground in June 2011 and was completed in 12 months. Key project elements included: ▪ Removal of existing structures on the north side of Yosemite Slough canal along with debris and contaminated soils. ▪ Creation of seven new acres of tidal wetlands. ▪ Re-vegetation with native plants to increase local biodiversity ▪ Creation of a nesting island for shorebirds, isolated by a tidal channel to protect nesters from feral animals and human disturbance. ▪ Reduction in the amount of polluted runoff as a result of restored seasonal wetlands catching and filtering water. ▪ Completion of a segment of the Bay Trail.	Thank you for your comment. The EPA appreciates the work of the California State Park Foundation. For the reasons provided in Section 9.2.2 of the EE/CA, the EPA believes that Alternative 5 is the best response action to address the hazardous substance contamination at the Site. With respect to the CPSRA wetlands restoration project, the EE/CA, Section 6.1, has the following removal action objective to guide in the Site cleanup process: • **Prevent Site Recontamination and Prevent Contaminant Migration to Adjacent Areas.** Provide a remedy that (a) prevents, to the extent practicable, the migration of resuspended sediment during or following any removal operations to adjacent areas (e.g., California Parks wetland restoration areas, other wetland restoration areas, and South Basin), and; (b) ensures that the Yosemite Slough is not re-contaminated following remediation (i.e., permanence of the remedy).

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			Phase II of the restoration project will include construction on the south side of Yosemite Slough to remove contaminated soils and rock fill, re-grading to restore the land to tidal influence including the creation of 3 new wetlands acres, the creation of a second isolated bird nesting island and, re-vegetation with native species. Phase III will complete the project by enhancing the local park so that its educational and recreational potential can be fully realized. We have reviewed the proposed EPA cleanup plan of Yosemite Slough including the cost alternatives. We appreciate the inclusion of our comments to –date including your requirement for additional hydro modeling as part of the design phase. We feel that it is essential that the EPA insure that dredge depth and cap depth reinforce the ecological gains achieved through the Yosemite Slough wetlands restoration project. As a champion for Candlestick Point State Recreation Area and key fundraiser for the Yosemite Slough Wetlands restoration, we *urge* you to adopt a cleanup plan that is respectful of the already completed cleanup effort and specifically maintains the biological and environmental integrity of the restored site and wetlands.	
Written Comments from Danita Rodriguez, District Superintendent, California State Department of Parks and Recreation, dated September 13, 2013				
66.			State Park's land and improvements [Candlestick Point State Recreation Area (CPSRA)] adjacent to the Yosemite Slough including wetland restoration and bird island should be protected to the State's satisfaction during cleanup, including mud removal, dewatering, and transporting processes.	With respect to the CPSRA wetlands restoration project, the EE/CA, Section 6.1, has the following removal action objective to guide the Site cleanup process: • **Prevent Site Recontamination and Prevent Contaminant Migration to Adjacent Areas.** Provide a remedy that (a) prevents, to the extent practicable, the migration of resuspended sediment during or following any removal operations to adjacent areas (e.g., California Parks wetland restoration areas, other wetland restoration areas, and South Basin), and; (b) ensures that the Yosemite Slough is not re-contaminated following remediation (i.e., permanence of the remedy). In its role as the lead regulatory agency for the

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				response action, the EPA will make determinations concerning short-term and long-term protectiveness. These determinations will be incorporated in response action design and in implementation of Alternative 5.
67.			If clean-up activities prevent daily tidal flow from reaching the wetland plants on State Park property or if the water course is redirected away from the wetland area, then wetland plants shall be irrigated as part of the project.	Appendix F of the EE/CA contains federal and State ARARs concerning wetlands protection that the Yosemite Slough cleanup project must address. No changes were made to the EE/CA due to this comment.
68.			If State Park's wetlands and upland cover is damaged in any way by Yosemite Slough cleanup efforts, areas affected should be restored to original condition without cost to State Parks.	Appendix F of the EE/CA contains federal and State ARARs concerning wetlands protection that the Yosemite Slough cleanup project must address. No changes were made to the EE/CA due to this comment.
69.			All construction debris/brick ruble on beach should be removed above and below the mean high tide elevation, as part of this Yosemite Slough clean-up effort.	The Site boundaries for the EPA's Yosemite Slough clean-up project are defined in the EE/CA, Section 2.1. In the Project design phase, protocols for removing debris within the Site boundaries will be defined. At this time, the EPA anticipates debris removal to include debris within the active excavation/construction zone and any observable debris (e.g., concrete, metal objects, and shopping carts) elsewhere within the Site boundaries whose removal would not create unacceptable short-term risk and contaminant migration. .
70.			State Parks is concerned with the EPA's use of a six inch biological active zone (BAZ) West of Griffith outfall which is too shallow for this area, as the area is a mudflat for a majority of a 24hour period. EPA should substantiate its BAZ findings and provide at least 12" to 18" of "Clean Bay Mud" to the West of Griffith outfall.	For the purposes of the alternative analysis in the EE/CA, the EPA set the BAZ to be 6 inches deep with an 18-inch margin of safety. The EPA's selected response action, Alternative 5, allows for the margin of safety to be re-evaluated during the design phase.
71.			All dewatering of lead- and PCB-contaminated mud processes should have engineering controls in place to prevent the contaminants of concern	The EPA agrees with this comment. The engineering controls for the sediment processing area will be developed during the Project design phase.

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			compromising the area staging area is placed on.	
72.			The Yosemite Slough area is a windy area and prevailing winds blow over CPSRA and into the San Francisco Bay. EPA should have engineered controls in place to prevent any contaminated material to be airborne, whether during the removal, dewatering, or transporting phases. There should be wind protection devices in place to protect CPSRA visitors and adjacent areas.	The EPA agrees with this comment. The EE/CA, Section 8.1.5, states that a Project air quality protection program will be developed during the Project design phase.
73.			EPA should ensure there are no impacts to existing adjacent land during the dewatering process.	The EPA agrees with this comment. The engineering controls for the sediment processing area will be developed during the Project design phase.
74.			EPA should have engineered controls in place to ensure that odors are strictly controlled during dewatering process so that no offensive odors affect CPSRA visitors or the adjacent residents. EPA should establish a protocol for eliminating the odors should they become a nuisance during the dewatering phase and an EPA contact for complaints while dewatering is taking place.	The EPA agrees with this comment. The EE/CA, Section 8.1.5, states that a Project air quality protection program will be developed during the Project design phase.
75.			As the dewatering site may be an attractive nuisance, the dewatering site should be fenced and have adequate security personnel with an EPA placard/sign with an EPA 1-800 contact number for an EPA point-of-contact.	The EPA agrees with this comment. The sediment processing area will be staffed with security personnel and a placard sign will be posted with contact information for the EPA along with other Project information.
76.			EPA should recommend geo tubes and not mud piles.	The EE/CA, Section 8.1.7, states that the specific method of sediment dewatering will be determined during the design stage, and based on the type of dredging method chosen, the amount of upland space available for dewatering, and the quantity of material to be removed. The EPA has successfully used the geotube technology for sediment dewatering at many sediment cleanup sites nationwide.
77.			If State Park property is requested for use for dewatering the mud (in the geo tubes), then State Parks will be reimbursed for the fair market value rent for the use of the land and the appropriate State Right of Entry Permit or other land use document (as determined by State Parks) will need to be executed with associated processing fees paid and related State Park's CEQA performed. Final staging and dewatering area footprints should not impact the pending expansion of the community garden and should be coordinated with the State Parks District Superintendent or designee.	The EE/CA, Section 8.1.7, states that the property or properties used for Project staging and sediment processing would be leased for access and use during response action implementation. Details concerning lease agreements will be determined during the Project design phase.

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			Additionally, because a portion of the State Park property, noted as a potential dewatering site, is a part of land transfer agreement, then other party's acceptance of the temporary use may be required.	
78.			If EPA's clean-up of the Yosemite Slough and "dewatering of the mud" timing is such that the condition of the State Park property that is requested for use has changed as such that the area is no longer a feasible location for the dewatering, than a Plan B should be utilized; or if the requested use of the portion of State Park property is no longer under our ownership, than EPA will need to coordinate with new owners or revise its plan.	The EPA agrees with this comment based on its understanding that State Parks will not compromise the feasibility of the dewatering area requested for use. The EPA expects to coordinate with State Parks or other relevant owners when making a determination regarding feasibility.
79.			State Parks requests EPA to incorporate aesthetic bank stabilization using the Bay Trail and bio swales that are consistent with CPSRA's general plan and the vision for the development of this area within CPSRA.	Park-related site improvements (e.g., Bay Trail) are not within the scope of Alternative 5, the selected response action. However, the EE/CA, Section 8.1.3, presents a framework of upland source controls to protect the quality and protectiveness of the response action. The EPA looks forward to coordinating with State Parks on the EPA cleanup project and State Parks wetlands restoration project at Yosemite Slough and working together to the benefit of both projects.
80.			There is a potential for listed species to be in the Yosemite Slough and adjacent areas, so EPA should obtain appropriate permits from State and Federal agencies. Additionally, EPA should use measures to avoid and minimize impacts to those species and measures should be implemented in consultation with US Fish and Wildlife Services and CA Department of Fish and Wildlife.	The EE/CA, Appendix F, identifies the Applicable or Relevant and Appropriate Requirements (ARARs) that will apply to the planning and implementation of the selected response action at the Site. Appendix F identifies both federal and State ARARs for natural resources at the Site.
81.			Based upon the modeling that was done, the Slough is generally depositional. The most critical location would be at the mouth of the slough. It would be appropriate that the design show that 1-foot is sufficient, and if not, the cover depth should be increased. It is suggested to use 1-foot of cover only in the most protected areas at the upper end of the basins.	The EPA agrees with this comment. The EPA will require additional hydrodynamic modeling of Yosemite Slough during the design stage to better estimate net erosion potential within the Site based on the current and future projected geometries of the slough to ensure the long-term protectiveness of the response action selected for the Site.
82.			It is assumed that EPA's post remediation bathymetry would be similar to existing. It is conceivable that the final bathymetry will be lower than existing. If so, this could change the hydraulics not only for the slough but for our basins as well, especially at the interface with the slough.	The EE/CA, Section 6, identifies the RAOs and RGs that the selected response action must achieve. RAO No.4 states the following: *Support and Protect Healthy Aquatic and Benthic Communities. (a) Limit or reduce the potential risk to aquatic and benthic communities; and (b)*

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				establish post-remedial slough bottom conditions that support slough habitat (i.e., tidal mudflat) and a healthy benthic ecology. Based on RAO No.4, the design of the selected response action will be directed to maintain existing bathymetry so that this RAO can be achieved.
83.			Any modeling that EPA does should include our plans for the South Basin, or possibly include both with and without South Basin bathymetry.	The EPA generally agrees with this comment. Hydrodynamic modeling for the Site to be conducted during the design stage should consider current and future anticipated bathymetry for South Basin. In addition, please see the EPA's response to U.S. Navy General Comment No.1.
84.			The biological suitability of sand depends on what the ultimate goals are for the area that contains the sand. Sand can be good substrate for eelgrass and other sub-tidal species, and sandy areas are in relatively short supply in our muddy Bay. Imported/engineered sand is typically not the ideal substrate. Salt marsh establishment can be affected due to sand's low concentration of organic material coupled with the compaction that is required for a cap. There are many areas with relatively sandy soils where tidal marsh vegetation does just fine. State Parks requests EPA to provide communication and allow State Parks' input during the design phase for the design specifications for the cap (depth-thickness, material, and compaction being key components).	The EPA agrees with this comment. The EPA will coordinate with State Parks and other interested parties concerning important Project details and specifications that will be determined during the Project design phase.
85.			State Parks requests that the Yosemite Slough's remediation be consistent with the ecological goals of the California State Parks Foundation/State Park's remediation/restoration project. State Parks requests to be included in the design phase to contribute to design specifications. (i.e., to determine the dredge and cap thickness), and to select the final capping materials. It appears the EPA will be requiring additional hydro modeling as part of the design to ascertain the scouring/depositional environment.	The EE/CA, Section 6, RAO No. 1 states the following: o *Protect Current and Future Beneficial Uses.* Remediate COCs in a manner that provides protection of human health and the environment based on reasonably anticipated current and future beneficial uses of the Yosemite Slough including those described in the Regional Water Quality Control Board's Basin Plan and the California State Parks General Plan for the CPSRA. The EPA plans to coordinate the Project design,

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				including additional hydrodynamic modeling with State Parks and other interested parties.
86.			State Parks requests that EPA consider the clean-up goal closer to the goal determined by RWQWB for the California State Parks Foundation/State Parks' remediation/restoration project as it is in closer proximity and a better comparison than the Hunter's Point Shipyard remediation goal.	The EPA carefully considered sediment cleanup goals throughout the EE/CA development process. The EPA believes the sediment RGs established in the EE/CA, Section 6.2, are protective of human health and environment at the Site.
87.			EPA should ensure regular communications with State Parks at all stages of the Yosemite Slough clean-up by having the District Superintendent, or designee, at all meetings during design and implementation.	The EPA agrees with this comment.
88.			EPA should continue its outreach and communication about this project to all residents and businesses in the area.	The EPA agrees with this comment.